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MINERAL RESOURCES IN RAJASTHAN: THEIR DEPOSITS AND PRESENT POSITION IN ECONOMY OF STATE

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ABSTRACT

Economy of Rajasthan is recognized as a developing economy. Rajasthan is located in north-western part of India. It is largest state in the country with an area of 3,42,239 sq. km. encompassing about 11% of the total geographical area of the country. Infrastructure development is essential to overall development of economy of the state. At present minerals is most important component of infrastructure. A mineral is a naturally occurring, inorganic substance with a definite chemical composition and a crystalline structure. Rajasthan is a largest state of India. It boasts the three natural heritages: The Arravalli Mountain Range, The Thar Desert and The Minerals. The state is a big treasure trove of mineral of indescribable qualities. Rajasthan is blessed with 79 varieties of minerals. Markedly the area of under mining is approximately 1,846 sq. km. which is only 0.54 of total land cover in the state. The state has virtual monopoly in the production of minerals like Lead-Zinc, Gypsum, Soap Stone, Ball Clay, Calcite, Rock Phosphate, Feldspar, Copper, Jasper, Garnet, Wollastonite, Silver etc. The state is proud to posses huge reserves of Lignite, Crude Oil and High Quality Gas. It is also renowned for its deposits of Marble, Sand Stone and some unique decorative stones. Mining is not only a major source of employment in the rural and tribal area of the state, but also a major source of revenue to the Government and minerals playing an important role in the development of the state. In this context, this paper covers deposits of various minerals, mineral fuels and their position in state.

KEYWORDS: *Developing Economy, Infrastructure Development, Natural Heritages, Mineral Fuels.*

Introduction

Rajasthan has been regarded as a 'Museum of Minerals'. Rajasthan possesses a variable range of mineral deposits in India. Rajasthan ranks next to Jharkhand in the matter of availability of minerals. The total number of minerals occurs in Rajasthan is 79, out of which 58 are being commercially exploited. Its share is 9% in the country's total mineral production. The state is the sole producer of Garnet, Jasper, Selenite and Wollestonite. The state has monopoly in production of Lead-Zinc, Silver, Cadmium, Marble, Precious and Semi-Precious stones. Some other significant minerals of the state are Copper, Silica and Quartz, Cement, Mica, Barytes, Pyrophylite, Fluorite, Graphite and Bentonite, Asbestos, China Clay, Dolomite, Magnesite, Rock-Phosphate, Soapstone etc. The lack of Coal and Iron-Ore not only hindered the state in mining industries in the past, but it will have influenced even in its future development. Income from mining sector was Rs. 7,300 crore at 2004-05 prices, which was 3.70 % of Net State Domestic Production of the year 2011-12. The mineral sector provides direct employment to 5.06 lakh people and indirect employment to more than 20 lakh people in the secondary and tertiary sectors. Rajasthan ranks first in the production of minor minerals by contributing 30 % share of the national production. The state ranks 5th in terms of the value of major minerals produced in the country. The petroleum sector has started giving huge revenues to the state and touched a level of 5,300 crores in 2014-15. The following table shows the minerals found in Rajasthan which account for 70 % or more of India's total production:

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Table 1: Minerals Found in Rajasthan Accounts 70% or More of India's Total Production

Minerals	% of India's Production	Minerals	% of India's Production
Wollastonite	100	Lead Concentrate	80
Jasper	100	Rock Phosphate	75
Zinc Concentrate	99	Ball Clay	71
Fluorite	96	Calcite	70
Gypsum	93	Sand Stone	70
Marble	90	Kota Stone	70
Asbestos	89	Felspar	70
Soapstone	87		

Sources: Some Facts About Rajasthan, 2015(DES).

Some new mineral reserves have been located in recent years. Steelgrade limestone reserves of 50 crore tonnes founds in 'Sonu region' of Jaisalmer district. On 6th July, 1990, a reserve of natural gas was located at Dandewala in Jaisalmer. Total 9 areas of oil and gas have been located in Barmer-Sanchor basin and total annual capacity of production is 35 crore tonnes. The quality of oil is very high. Mineral wealth of Rajasthan has a pivotal role in the state and national economic development. Mineral based industries and many subsidiary industries are directly based on minerals. The major mineral based industries are: Copper smelting, Zink smelting, Pyrite smelting, Cement, Phosphate fertilizer, Glass, Pottery, Marble, Flourite, Soap-stone, Powder industry. Mineral based industries are increase the employment potential and economic status of the people. Mineral like Gypsum, Rock Phosphate, Lime and Pyrites are helpful for soil treatment and agriculture development. Minerals have also helped in the development of transportation, communication and settlement in remote and desert areas. In this context this research paper covers mineral position of Rajasthan in India, various minerals in state, mineral fuels in Rajasthan etc.

Objective of the Study

The main objectives of the study are as follows:

- To know the major and minor minerals in Rajasthan,
- To discuss the various minerals in Rajasthan,
- To examine the position of mineral fuels in Rajasthan.
- To know the present position of mineral based industries in Rajasthan,

Methodology

Reviews and analysis of various studies and documents have made. The present study evaluates the mineral position and current position of mineral based industries in Rajasthan. This is a descriptive research paper and completely based on secondary data, which collects from reports, journals, books, magazines and websites.

Various Minerals in Rajasthan

Minerals of Rajasthan are classified into following sections:

- **Metallic Minerals**
  - **Copper Ores**: Rajasthan is a leading producer of the copper metal. Copper mines are located at Khetri, Kolihan, Chandmari in Jhunjhunu district and Khoh Dariba in Alwar district. Small amount of copper is found in Sirohi and Udaipur districts. Some mineral surveys in Rajasthan have spotted new copper areas in Sikar, Alwar, Bhilwara, Sirohi districts. The production of copper ore was 10 lakh tonnes in 2013-14.
  - **Lead-Zinc Ore**: The important mines of lead-zinc ore are at Zawar, 40 km. far from Udaipur. A very rich lead-zinc ore mine was located at Rampura-Agucha in Bhilwara district. The Hindustan Zinc Ltd. is working on this project. A Zinc Smelter Plant is being set up as Chanderia in Bhilwara district. In 2013-14, production of lead zinc has been estimated at 72.8 lakh tonnes.
  - **Iron Ore**: Good quantity of iron-ore is found in Jaipur, Udaipur, Jhunjhunu, Sikar and Alwar districts. In 2013-14, production of iron-ore was 29.8 lakh tonnes.
  - **Manganese Ore**: There is very little quantity of output of manganese ore in the state. Some quantity of manganese ore is found in Banswara district.

- **Tungsten**: Tungsten is found at Degana in Nagaur district. It is used in the manufacture of special steels and electronic equipments. It is also supplied to the department of defence. Major portion of tungsten production in India comes from Rajasthan.

Industrial and Non-Metallic Minerals

These type of minerals have divided in the following categories:

- **Refractories and Ceramic Minerals:**
  - **Asbestos:** It is used for manufacturing asbestos cement, pipes, roof-sheets etc. Its reserves are found in Udaipur, Dungarpur, Bhilwara and Ajmer districts. Rajasthan produced about 89 percent asbestos in the country.
  - **Felspar:** It is used in the manufacture of glass, clay, utensils etc. It is mainly found in Ajmer district. Small quantity of felspar is found in Sirohi, Udaipur, Alwar and Pali districts. Its production was 16.7 lakh tonnes in 2013-14.
  - **Magnesite:** It is used in the production of refractory bricks. Some quantity is used in glass industries. It is found in Ajmer district. Its production was nil in recent years.
  - **Silica Sand-** It is used as a raw material in the glass industries. It is mostly obtained from Jaipur and Bundi districts. In 2013-14, its production was 9.96 lakh tonnes.
  - **Dolomite:** It is obtained from Ajmer, Alwar, Jaipur, Jodhpur, Jaisalmer and Sikar districts. It is used for manufacturing chips, powder, lime and glass.
  - **Wollastonite:** It was found in Sirohi district in 1969. Rajasthan is the sole producer of wollastonite in India. It is used in the ceramic industry and in the paint and paper industry.
- **Electronic and Atomic Minerals:**
  - **Mica:** Mica mines are found in Bhilwara, Tonk, Ajmer, Jaipur and Udaipur districts. It is used in electrical appliances and in the manufacture of rubber tyres. Most of the mica production comes from Bhilwara district. Its production was 7,280 tonnes in 2013-14.
  - **Atomic Minerals:** Some quantity of lithium is found in the mines of Ajmer and Rajgarh. Some amount of beryl is found in mica mines. Position of Rajasthan in atomic minerals is quite encouraging.
- **Fertilizer Minerals:**
  - **Gypsum:** About 93 % production of gypsum in the country comes from Rajasthan. Mines of gypsum are located in Bikaner, Shri Ganganagar, Churu, Nagaur, Barmer, Jaisalmer, Jalore and Pali district. It was largely used in the manufacture of plaster of paris. It is also an important raw material for the fertilizer and cement industry. In 2013-14, the production of gypsum was 30.88 lakh tonnes.
  - **Rock Phosphate:** Rock Phosphate has placed India on the world map of its producers and it has been designated as a vital mineral of Rajasthan. The deposits of Jhamar-Kotra in Udaipur district are the largest in the country. Rock phosphate is used in the production of super-phosphates. Its production was 11.2 lakh tonnes in 2013-14. Government earns crores of rupees by the sale of rock phosphates.
  - **Pyrites:** A large deposit of pyrites has been found at Saladipura in Sikar district, which is still in the stage of development. Sulphuric acid is obtained from it, which is used in the fertilizer industry.
- **Minerals for Chemical Industries:**
  - **Limestone:** Important deposits of limestone are found in Ajmer, Udaipur, Jaisalmer, Banswara, Bhilwara, Chittorgarh, Sirohi and Pali districts. Steel grade limestone reserves of about 50 crore tonnes are found in the 'Sonu region' of Jaisalmer district. In 2013-14, the production of dimensional limestone was 46.6 lakh tonnes and the burning type was 77.3 lakh tonnes.
  - **Fluorite:** Its reserves are found at Mando-ki-Pal in Dungarpur district. It is used in steel, aluminium industries and also used for making hydrofluoric acid. Some quantity of fluorite is found in Jalore district also. Gujarat and Rajasthan is the only producer of fluorite in India.
  - **Barytes:** This mineral is used for drilling muds of oil wells. It has been regarded as a useful material for the production of paint, lithophane and barium chemicals. It's found in Alwar district and near Nathdwara.

- **Minor Minerals:**
  - **Bentonite:** It is used in drilling mud and in paint and pharmaceutical industries. It is found in Barmer and Sawai Madhopur district. Total 15 % bentonite output of India comes from Rajasthan alone.
  - **Marble, Granite and other Building Stones:** Marble was used in the construction of Taj Mahal at Agra. It is available in Nagaur, Sirohi, Pali, Alwar, Bundi, Udaipur and Jaipur districts. Its production was 132.1 lakh tonnes in 2013-14. Jaisalmer is famous for its yellow type of marble. Granite is found in 18 districts of Rajasthan. Different colors and verities of granite are found in the state such as pink, grey and black. The area of Jhunjhunu, Sikar, Jaipur, Ajmer, Dausa, Tonk, Sawai Madhopur, Barmer, Pali, Bhilwara, Jalore, Sirohi, Alwar and Rajsmand are prominent in the sale of granite. Sandstone, limestone and other building materials are also found in different parts of Rajasthan.
- **Miscellaneous:**
  - **Soapstone, Talc and Pyrophyllite:** Soapstone is a useful mineral for making cosmetic products, toys, paper, rubber, pesticides, ceramic and textiles. Deposits of soapstone are found in Jaipur, Udaipur, Bhilwara, Sawai Madhopur and Dungarpur districts. Pyrophyllite is like soapstone but different in chemical properties. Its uses are similar to that of soapstone.
  - **Calcite:** It is used for making paper, textiles, paint etc. It is found mostly in Sikar district. But small quantities are available in Sirohi, Jaipur, Pali and Udaipur districts.
  - **Ochres:** This is used to manufacture colors, cement, rubber, plastics etc. It is found in several places of Chittorgarh district.
  - **Salt:** Salt is produced in the Sambhar Lake of Rajasthan. Other areas are Deedwana, Lunkaransar and Pachpadra.

Following table shows the production of some important minerals in Rajasthan:

Table 2: Production of Some Important Minerals in Rajasthan

Minerals	Production (in '000 Tonnes)	
	2012-13	2013-14
A. Major Minerals		
I. Metallic Minerals		
Copper Ore	980.52	1003.012
Iron Ore	533.12	2983.222
Lead-Zinc	8632.18	7282.457
Silver	0.29	0.259
Cadmium	0.40	0.291
II. Other Minerals		
Ball Clay	2474.19	3111.317
Calcite	62.09	93.464
China Clay	1719.22	1881.198
Dolomite	896.02	367.771
Felspar	2074.62	1668.535
Gypsum	2717.85	3087.783
Limestone	50289.90	56672.267
Mica	7.18	7.280
Ochres	1947.96	2746.002
Quartz	693.72	1789.123
Rock-Phosphate	1439.73	1117.573
Silica Sand	800.44	996.456
Soapstone	804.65	809.630
Wollastonite	188.79	190.646
Lignite	7365.04	7685.719
B. Minor Minerals		
Limestone (Burning)	6277.25	7734.66
Limestone (Dimensional)	5237.30	4660.64
Marble	13876.89	13208.52
Sand Stone	16380.96	32513.29

Sources: Some Facts About Rajasthan, 2015, p. 85.

The above table of production of minerals in Rajasthan shows that, Rajasthan is 'Museum of Minerals'. Rajasthan has mining some major and minor minerals year to year and quantity of minerals production have increased year to year. Copper Ore, Iron Ore, Lead Zinc, Limestone, Rock-Phosphate, Marble, Sand Stone are the lead minerals which mining in Rajasthan.

Contribution of Mining Sector in State's Economy

The mining sector has affected every segment of life, like improvement in infrastructure, health and medical, education, skill development, providing sustainable livelihood to a large number of people belonging to weaker section of the society. The mining sector contributing 4.4% to the state's GDP. The mining activity has benefited in the local area development which is visible in the form of social infrastructure like school building, health centers, children playgrounds, availability of drinking water etc. Greenery is an added benefit to society through sector. Most of the mine operators plant trees in and around their sites and also at the over-burden areas.

Mineral Fuels in Rajasthan

- **Lignite Deposits:** Lignite Coal is found in large quantity in Rajasthan. It largely used for generating thermal electricity in the state. Lignite deposits of over 100 crore tonnes have been proved in Bikaner, Nagaur and Barmer districts. The higher reserves of about 60 crore tonnes have been indicated in Barmer district. The reserves in Bikaner district have been estimated at a level of 23 crore tonnes. The reserves in Nagaur district are estimated at a level of about 20 crore tonnes. The state is power-deficient at present. Therefore, the deposits of Palana, Gurha, Barsingsar and Bithnok in Bikaner district and Kapurdi, Jalipa in Barmer district have been reserved for power generation. The deposits near Giral in Barmer district are being assigned to Rajasthan State Mineral Development Corporation (RSMDC) Ltd. and those near Kasnau-Igyar to Rajasthan State Mines and Minerals (RSMM) Ltd. for exploitation and supply of lignite for use as industrial and domestic fuel. Lignite-based thermal power project of 500 MW Barsingsar project was started. An agreement for the purchase of electricity was entered with Hindustan Power Corporation on 16th December, 1996. The lignite reserves at Barsingsar, being about 7 crore tonnes, can be mined for about 35 years.
- **Petroleum and Natural Gas:** In Rajasthan, reserves of natural gas and crude oil have been indicated mostly in the Jaisalmer and Barmer districts. The State Government has tried to increase the production of natural gas and crude oil so that the related developments may follow in due course. Private, domestic and foreign investment will have to be tapped to develop the mineral and power resources of the state. There is a simultaneous development in these sectors along with the infrastructural development so that Rajasthan may be in a position to tackle problems of poverty and unemployment in future. The report of the S.C. Tripathi Committee says for this sector that, "Discovery of hydrocarbons in Rajasthan is a very happy event". The following table shows production and revenue by crude oil and natural gas in Rajasthan:

Table 3: Production and Revenue by Crude Oil and Natural Gas in Rajasthan

Years	Production		Revenue (Rs. in Crore)			
	Crude Oil (million barrels)	Natural Gas (mmscm)	Royalty on Crude Oil	Royalty on Natural Gas	Dead Rent PEL Fee, etc.	Total
2012-13	62.03	269.38	5,041.46	10.03	18.39	5,069.88
2013-14	65.61	449.12	5,905.31	31.49	16.31	5,953.11
2014-15	63.38	572.80	4,782.22	51.36	15.12	4,848.70

Sources: Rajasthan Mineral Policy, 2015, p.09.

Above table shows that in 2012-13, total 62.03 m.b. crude oil and 269.38 mmscm. natural gas produces in Rajasthan. Total revenue generated by state from crude oil and natural gas is Rs. 5,069.88 crore in 2012-13. In 2014-15, total 63.38 m.b. crude oil and 572.80 mmscm. natural gas produces in state. Total revenue generated by state from both minerals is Rs. 4,848.70 crore in 2014-15. It shows that total revenue is decreased in 2014-15. Total royalty generated from crude oil in 2012-13 was Rs. 5,041.46 crore and in 2014-15 it was Rs. 4,782.22 crore. Total royalty generated from natural gas was Rs. 10.03 crore in 2012-13 and in 2014-15 it was Rs. 51.36 crore. It shows that total royalty from crude oil was decreased and from natural gas it was increased.

Present Position of Mineral-Based Industries in Rajasthan

The position of Rajasthan is quite favorable from the point of view of availability of various types of minerals. There is a sound base for the development of mineral-based industries in Rajasthan. Zinc

Smelter, Super Zinc Smelter, Copper Smelter, Rock Phosphate Beneficiation Plant, Major Portland Cement Plants, White Cement Plants, Marble Processing Plants, Granite Processing Plants, Chemical Industries, Petroleum Refinery, Glass Industries, Industries Based on Petroleum Products, Ceramic and Insulator Units and Kota Stone Processing Units are Mineral Based Industries have come up in the state. There are many stone crushing, grinding and pulverizing plants, small stone cutting and polishing units, lime links, hydrated lime plants, brick kilns, plaster of paris units by using gypsum etc. More than 5,000 small scale registered units are scattered in different parts of the state today. There is a vast scope for the development of new mineral based industries in the state. More employment opportunities can be generated by adding value-addition in minerals by starting processing plants in the state instead of exporting them to other states in their raw form. This would add to the income of the state also. Zinc smelter plant is located at Debari near Udaipur, a new zinc smelter plant was planned to be set-up at Chanderia in Bhilwara district at estimated cost of Rs. 617 crore, Copper smelter plant is working at Khetri, rock-phosphate beneficiation plant has been planned for Jhamar-Kotra and fluorspar beneficiation plant is working at Mando-ki-Pal, Dungarpur. A fertilizer factory is being set-up at Gadhepan near Kota, Lignite deposits would be exploited at Barsingsar and an agreement has been with NLC in this regard. The state can take a big leap forward by developing its mineral resources related copper, lead-zinc, rock-phosphate, limestone, lignite etc.

Findings and Suggestions

It is very important and essential to develop the mineral sector in Rajasthan, because this sector not only provides huge employment in state, but also gives huge revenue to State Government. For improve the mineral sector priority should be given for the grant of mining leases to entrepreneurs who wants to install processing units. Term loan assistance should be given by the financial institutions. Private investments, domestic investments and foreign investments should be promoted by providing single window service. The state should prepare a clear plan for the development of mineral-based industries for the future. The state should spell out the plan mineral-wise, location-wise, technology-wise so that employment, income and export-earnings might be increased to a substantial extent in years to come. Such efforts like development of transportation, communication, rationalize mineral policy with timely implementation, public awareness, technological development, banking and insurance facilities, development of mineral based industries, better power supplies etc. should be done urgently.

Conclusion

Rajasthan is a state that is rich in minerals. The Rajasthan state is sanctified with 79 mineral varieties out of which 58 minerals are commercially subjugated. Rajasthan has effective domination in the manufacturing of major minerals like Lead-Zinc, Wollastonite, Gypsum, Calcite, Silver, Rock-Phosphate and other minerals like Wollastonite, Jasper, Fluorite, Gypsum, Sandstone, Marble etc., that contributes around 90% to 100% of national production. Massive reserve of Crude oil, Heavy oil, Natural gas etc. further add to the states mineral strength. Rajasthan contributes appreciably in the production of Lead-Zinc and Copper. Reserves of oil and natural gas are found in Barmer and Jaisalmer districts by ONGC. A total of about 480 million tonnes of oil reserves have been estimated in 25 oil and gas fields in Barmer-Sanchor Basin. Rajasthan is very much deficient in coal reserves. There is only some quantity of lignite coal found in Rajasthan. There are various problems such as physical, economical, technological etc. in the sector of mineral in the state. So Central and State Government should conscious to resolve the problems in mineral sector in the state.

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