



Mineral Reserves Of Jammu And Kashmir- A Case Study Of Lithium Reserves In Salal-Himania Lithium Fields

Abid Hussain Rather^{1*}, Reyaz Ahmad Wani², Gulzar Qadir Ganaie³, Mumin Akbar⁴

¹*Research Scholar, Department of Geography

²Research Scholar, Department of Geology

³Lecturer in Geography, Govt. S.A.M. Degree College Budgam

⁴Research Scholar, Department of Geology

*Corresponding Author: Abid Hussain Rather

*Research Scholar, Department of Geography

Abstract

The mineral and power resources are the backbone of industrial and technological development of a country or region. Moreover, transportation and accessibility, costs, and supply and demand are the major determinants of industrial development. It is often said that the economic prosperity, industrial development, technological advancement and overall social well-being of a region/country are largely dependent on minerals, power and human resources. The mineral and power resources are however, high unevenly distributed and in many cases they are not easily accessible. They are mostly exhaustible. However, large the deposits of a given mineral, the continuous mining will exhaust the ores.

Keywords: Mining, Minerals, Reserves, Lithium, GSI

I. Introduction

The Mining sector is an important segment of the Indian Economy and the country is endowed with huge resources of many Metallic and Non-Metallic Minerals. The words- "Mines" and "Minerals" are commonly used in immediate collocation. No general definition of either Mines or Minerals exists under English law. But in India both are precisely defined in the Mines Act 1952 (Act xxxv of 1952). But the Mines and Minerals (Development and Regulation) Act, 1957 has been categorically mentioned that what things are to be included in the Minerals and which are to be excluded. The word — "Mine" is derived from a Latin word — Minare which means to Lead; the interpretation of the word is to draw or lead a way, or passage underground a subterraneous duct course, or passage whether in search of Metal or to destroy Fortification³. The word primarily means an underground excavation for taking out minerals. Whether an excavation is a Mine or not depends upon the manner in which it is to be worked and not on substance which is excavated. What is mine is thus a question of fact. A Mine like a stream may be properly so called even if it extends through the property of various owners. In some cases, it has been assigned a meaning so as to include the space created as the Minerals is being worked out and the space left vacant after the Minerals have been completely worked out. The word Mines and Minerals have been clearly defined in The Mines Act 1952 under Section 2(j) and 2 (jj) respectively.⁸ It gives a broad clarification as to the Mining. In general, it means any excavation in which an operation has been or is being performed for the study or acquisition of minerals and often encompasses a range of other procedures. According to the definition of Minerals it means —all substances which can be obtained from Earth by Mining, Digging, Drilling, Dredging, Hydrauling, Quarrying or by any other operation and includes minerals oils (which in turn include Natural Gas and Petroleum). As per definition under The Mines and Minerals (Development and Regulation) Act, 1957 it includes all Minerals except Minerals Oil and Minerals Oil includes natural gas and Petroleum.⁵ Mining has been the second of human earliest endeavors and agriculture was first. Apart from that, the two industries ranked together as the primary or basic industries of earliest civilization and very minimum was changed in the importance of these industries since the beginning of Civilization. If we consider Fishing and Lumbering as part of agriculture and oil and gas production as part of Mining, then agriculture and Mining continue to supply all the basic resources used by modern civilization⁹. The overall sequence of activities in modern mining is often compared with the five stages in the life of a mine. They are-prospecting, exploration, development, exploitation, and reclamation. Prospecting and exploration precursors to actual mining are linked and sometimes combined." Geologists and mining engineers often share responsibility for these two stages and geologists are more involved with the former mining engineers more with the latter. Likewise development and exploitation are closely related; they are usually considered to constitute mining properly and the main province of the mining engineer. Closure and reclamation of the mine sites are the necessary part of the mine life cycle because of the demands of society for a clean environment and strict laws regulating the abandonment of a mine. The overall process of developing a mine with the future uses of the land in mine along with Conservation of Environment is termed as sustainable development. This concept was defined in a book entitled Our Common Future (World Commission on Environment and Development, 1987) as "development that meets the needs of the present without compromising the ability of future generations to meet their needs"¹⁰.

Mineral resources play a very important role in the industrial development of the State. According to the development the demand of minerals increases together with industrial development. Continuous work is being done by Mineral resources Department through conservation, exploration and continuous monitoring on exploitation of minerals under the Rules¹¹.

DEFINITION OF MINING

Mining or mining operations are the removals of minerals and metals from the land. There are only a few examples of manganese, tantalum, copper, tin, nickel, bauxite (aluminum ore), iron ore, gold, silver, and diamonds. Mining is a sector that generates profits. Not only mining companies flourish, but governments even make revenue money. Income and benefits also go to employees¹². So this mining business contributes towards development of nation as a whole.

DEFINITION OF MINERALS

The word —mineral” is also used inconsistently in geology. Everything extracted from the earth and used by man in mining is called a "mineral commodity" or a "mineral material." These include: The crushed stone is a substance made from crushed rocks. Lime; this is a substance composed of calcite (both of mineral calcite) made from calcite or marble. Organic coal, organic oil, and gas; mixtures of rock and stone, such as rocks of rock like obsidian, which have a specific composition and an orderly internal framework, are rocks such as granite¹³. To meet the definition of "mineral" used by most geologists, a substance must meet five requirements: (i) naturally occurring, (ii) inorganic, (iii) solid (iv) definite chemical composition and (v) ordered internal structure¹⁴.

Mineral Resources Jammu & Kashmir is the sole holder of country's borax and sapphire resources and possesses 36% graphite, 21% marble and 14% of gypsum. Coal, gypsum and limestone are the important minerals produced in the State. Coal occurs in Poonch, Rajouri and Udhampur districts; gypsum in Baramulla and Doda districts; limestone in Anantnag, Baramulla, Kathua, Leh, Poonch, Pulwama, Rajauri, Srinagar and Udhampur districts; and magnesite in Leh and Udhampur districts. Other minerals that occur in the State are bauxite, ball clay and china clay in Udhampur district; bentonite in Jammu district; borax and sulphur in Leh district; diaspore in Rajouri and Udhampur districts; graphite in Baramulla district; lignite and marble in Kupwara district; quartz and silica sand in Anantnag, Doda and Udhampur districts; quartzite in Anantnag district; and sapphire in Doda district (Tables - 1 and 2). The value of mineral production in Jammu & Kashmir at L169 crore during 2012-13 decreased marginally as compared to that of the previous year. The minerals produced in the state were coal, limestone and gypsum. Minor minerals dominate the value of mineral production contributing 95% of the total value of mineral production in the state followed by coal & limestone with 2% each and remaining contribution was from gypsum. In the year under review, the production of gypsum increased by 42% while it decreased by 5% and 15% respectively for coal and limestone as compared to the level of previous year. The production value of minor minerals was estimated at L161 crore for the year 2012-13. There were eight reporting mines in 2012-13 as against 10 in the previous year. The index of mineral production in Jammu & Kashmir (base 2004-05=100) was 92.1 in 2012-13 as compared to 92.5 in the previous year. Mineral-based Industry Jammu & Kashmir Cements Ltd, a State Government undertaking, operates a cement plant of 1.98 lakh tpy capacity at Khrew in Pulwama district. The company also owns a tiny cement plant of 20,000 tpy capacity located at Wuyan in Srinagar district besides two other tiny cement plants that have a total capacity of 39,000 tpy. The State also has a 1,800 tpy capacity Unit that manufactures ceramic and refractory products in District Kathua. A 3,000 tpy capacity calcium carbide plant is situated at District Pulwama.

Table - 1 : Reserves/Resources of Minerals as on 1.4.2010 : Jammu & Kashmir

Mineral	Unit	Reserves					Remaining resources					Total resources (A+B)		
		Proved STD 111	Probable		Total (A)	Feasibility STD211	Pre-feasibility		Measured STD331	Indicated STD332	Inferred STD333		Reconnaissance STD334	
			STD121	STD122			STD221	STD222						
Bauxite	'000 tonnes	-	-	-	-	-	-	1323	182	520	-	2025	2025	
Bentonite	tonne	-	-	-	-	-	-	-	-	147400	-	147400	147400	
Borax	tonne	-	-	-	-	-	-	-	-	-	74204	74204	74204	
China clay	'000 tonnes	-	-	-	-	-	-	-	-	28122	-	28122	28122	
Diaspore	tonne	-	-	-	-	-	-	-	566	711	-	1277	1277	
Graphite	tonne	-	-	-	-	-	-	-	-	1059520	61681035	62740555	62740555	
Gypsum	'000 tonnes	1664	153	442	2259	4784	9785	6570	7680	-	146694	-	175513	177772
Limestone	'000 tonnes	257480	5525	54100	317106	42116	21686	165199	43621	-	1001420	203	1274246	1591352
Magnesite	'000 tonnes	2610	740	-	3350	600	100	-	-	-	150	45	895	4245
Marble	'000 tonnes	-	-	-	-	-	-	-	-	-	404703	-	404703	404703
Quartz-silica sand	'000 tonnes	-	-	-	-	-	-	-	-	-	3110	-	3110	3110
Quartzite	'000 tonnes	1500	58	-	1558	-	-	-	-	-	-	-	-	1558
Sapphire	kg	-	-	-	-	-	-	-	-	-	450	-	450	450
Sulphur (native)	'000 tonnes	-	-	-	-	-	-	-	-	-	210	-	210	210

Figures rounded off.

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STATE REVIEWS

Table – 2 : Reserves/Resources of Lignite as on 1.4.2013 : Jammu & Kashmir

(In million tonnes)				
District	Proved	Indicated	Inferred	Total
Total	-	20.25	7.30	27.55
Kupwara	-	20.25	7.30	27.55

Source: Coal Directory of India, 2012-13.

II. REVIEW OF LITERATURE

Banikanta and Sagarika Mishra (2014) conducted a study on “Mining and Industrialization: dangerous portents”. In this article the author has broadly described the impact of mining and industrialization and what is possible threat in it. The author has discussed that if mining can be considered as an industry then what will be the effect on environment and how it can be totally considered as an industry. The author has discussed the various aspects of mining industry. In this study the author has confined his study only to the relation of mining and industrialization. But in my study I have discussed the concept that how mining and industry are complementary to each other. Side by side it will also be discussed that what steps are required for the better implementation of existing provisions of laws relating to mines and minerals in India.

Devsh Chaturwed, Mahesh Chauhan and Praveen Tripathi 2003 conducted a study on “Grant of Mining Lease to Self Help Groups in Shankargarh Block of Allahabad District: A Case Study”. In this article the authors has discussed the concept of self-help group in Mining arena. The author has broadly discussed the grant of mining lease to self-help group. This is a case study of a block in the Allahabad district of state of Uttar Pradesh. Author has described that what are the Major Minerals which could be found in that area. The author has discussed the miseries of laborers in that area. What are the steps which have been taken by the district administration? The author has emphasized to grant the mining lease to the self-help group in other parts of the country also. The author has discussed the working conditions of mine workers those who are specifically involved in the mining. What are the possibilities of improvement of miner in that district? In our study we will discuss that what steps can be taken for the upliftment of mine workers and how the environment of mining can be made safe for workers and community.

Rahul Basu, 2012 conducted a study on “Mining in Goa: Beyond Forest” In this article the author has discussed the effect of mining in the coastal areas particularly in Goa. In this article author has elaborated the ethical concerns and methodological issues in context of mining. What is the impact of state policy on mining in those areas. They also suggest the closure of mining in the state. In this article they only discussed the ethical implication of states. The author has discussed that mining should be stopped. But in our study we will discuss that how the mining can be controlled in the state not only in Goa but in other states also.

Raman Malhotra, 2011” Mines and Minerals Laws” In this book the author Raman Malhotra has described the various laws of mines and minerals which are necessary to regulate the mines. In this book the author has discussed those laws in details which are required to be in the country for the development of mines. The author has also thrown light on various enactments that have played important role in the development of mining laws. The author has also discussed in detail that how these mining laws can be helpful in development of minerals. The author has covered a broad spectrum of issues shaping the current paradigm of mineral sector governance. The aim of the study is to understand trend and development of mine and minerals laws and policy at various level i.e. International and National level. But the author has not discussed the issues of royalty in minerals. How a royalty is to be decided and how it is to be paid. No particular formula is there. It is different from state to state. Our study will focus that how a uniform royalty is to be decided and how it is to be distributed.

A natural inorganic substance possessing a definite chemical composition and almost always in a crystalline form is called mineral. Mineral is formed by the inorganic processes of nature. This definition includes ice as a mineral but excludes coal, natural oil and gas. The only allowable exception to the rule that a mineral must be solid is native mercury (quicksilver) which is a liquid. The state of Jammu and Kashmir is well endowed with forest, and water resources. It is however, deficient in coal, petroleum, natural gas, iron-ore, manganese, thorium, uranium, aluminium, mica, sillimanite, phosphates, dolomite, mercury, silver, etc. Some of the important minerals found in the state are copper, lead, zinc, bauxite, chromium, gold, arsenic, kaolinite, bios-pore, ochre, coal, lignite, slate, marble, sapphire, rubellite, quartz and serpentine. A brief account of the spatial distribution of minerals in the state has been given in the present article

Coal

Coal is the most important of the minerals which helps in the industrial development of a region. Coal is a combustible rock which has its origin in the accumulation and partial decomposition of vegetation. Coals differ in the kinds and manners of preservation of plant material (type). They vary in degree of carbon concentration and in the amount of

inorganic impurities. The main types of coal are anthracite, bituminous, lignite and peat. The state of Jammu and Kashmir has very limited coal deposits. It is the Riasi Subdivision of the Udhampur district in which coal of anthracite quality occurs in some widely distributed seams of 30 cm to 6 cm in thickness in association with nummulitic strata. The latter occur as inliers in the Murree Series. Spread over a length of about 80 km (48 miles) and sandwiched between Sirban limestone on the one hand and Murrees on the other, within the Eocene formation the coalfields are unlike the Gondwana coalfields in which the limits are well-defined by faults and/or older rock. The intense and complex tectonic movements, however, have restricted the limit of coalfields up to the extent these can be economically exploited. The high grade of Jammu coal is due to the organic forces, affecting the coalification increase towards the west, thus, carbonizing the original vegetal deposits. Middle miss has estimated the quantity available at 100,000,000 tonnes with mining at ordinary depth. Some of the Riasi semi-anthracite contain 60 to 82 per cent of fixed carbon. Field survey and prospecting conducted by the Geological Survey of India in the 1980s, reveals that lignite, anthracite, and peat deposits are found in small quantities in some areas of the Jammu and Kashmir divisions. The coal deposits of the state do not belong to the carboniferous period. They have their origin to the Lower Tertiary, Eocene, or Oligocene periods, and are found in association with Nummulitic limestone (Murree Series). They have low carbon contents, ranging between 50 to 60 per cent. The major coal deposits of the state are found at Kalakote, Jangalgali, Metka, Ladha, Chinka, Dhansal, Swalkote, Chakar, Dandil, Mohogala, San- gar-Marg, and Kura. Coal has also been reported from the Baramulla, Handwara, and Pulwama districts of Kashmir. Lignite is found at Shaliganga, Chowkibal and Nichahama (Kashmir Division). It has been estimated by the Geological Survey of India that the Kalakote coal mines have a workable reserve of about 5.4 million tonnes up to a depth of about 300 m. An analysis of the Kalakote coal reveals that it is of low volatile anthracite grade with ash content varying from 10 to 20 percent and fixed carbon about 60 to 80 per cent. In Ladda and Jangligali coal field's reserves are estimated to be about five million tonnes. The coal of Ladda also has about 50 per cent carbon and about 20 per cent impurities and moisture contents. The Geological Survey of India has carried out explorations at Mohogala and Metka (Poonch District) and arrived at the result that these places, up to a depth of 300 m have about 9 million of coal. The fixed carbon in the coal of these deposits is about 57 per cent, volatile 30 per cent and ash and moisture 10 and 3 per cent respectively. At present coal is being mined near Kalakote to feed the only thermal power plant of the state at Kalakote. The rated capacity of the plant is 7.5 MW and 35,000 tonnes of coal is being mined annually in its vicinity. The energy generation capacity of the plant may be enhanced substantially if new generators are installed in the Kalakote Plant and new technology is applied for the mining of coal. Lignite deposits are found mainly in the Valley of Kashmir which occur in the Karewa formations, right from Nichahom up to Lolab. The lignite seams are, however, associated with clays and loams and are inter-bedded in carbonaceous clays in various localities of Kashmir Division. The major lignite deposits are in the vicinity of Nichahom, Chowkibal, Budhasheng, Lanylab, Shaliganga, Raithan and Tangmarg. According to the Geological Survey of India, Nichahom lignite seams occur from north to south, running over a distance of about 85 km and the estimated reserve of lignite in this mine is about 85 km and covering a width of 16 km up to a depth of 8 m. The estimated reserve of lignite in this mine is about 6 million tonnes. In between Nichahom and Chowkibal a reserve of 8 million tonnes has been estimated. The total estimated reserve of lignite deposits in the state, according to the Directorate of Geology and Mining is about 85 million tonnes, but owing to thin seams and high ash contents, it is mined only at Nichahom in Kashmir. In fact, the lignite of Kashmir Valley contains only 8 to 25 per cent carbon, 30 per cent ash, 15 per cent moisture and 27 per cent volatile matter. Peat—a superficial accumulation consisting of vegetation matter which has become decomposed to a certain limited extent in the cold regions is also found in the Valley of Kashmir. Its deposits are found mainly in the swampy grounds on both the sides of the Jhelum River below Srinagar. Peat is cut and dried before being used as fuel. It is applied in field as a manure. The Kashmiris call peat as demb-tsak.

Natural Gas

Natural gas has not been struck so far in any part of the state. In Jammu Division, areas like Ramnagar, Dharmthal, Nauashara and Rajauri are under investigation for natural gas. Occurrence of dry gas has been reported by the Oil and Natural Gas Commission (ONGC) in the Kashmir Division. The ONGC has proved the existence of 'Dry Gas' at the Silk Factory Road, Ram- bagh (Srinagar). Various indications such as sulphurous water, hot springs, gas seepage, etc., have been noticed in several areas of Jammu and Kashmir which prove that in near future oil and natural gas may be found in the state.

Metallic

There are a few metallic minerals found in the state. Though at present the state is producing very little metallic minerals, there are evidences which prove that gold and copper have been mined in the Ladakh and Kashmir divisions respectively since the medieval period. The occurrence of metallic minerals in the state is in isolated tracts and in many cases their exploitation is uneconomic. A brief description of some of the metallic minerals found in the state is given in the following paragraphs.

Iron-ore:

Iron-ore is obtained from hematite and magnetic mainly found in igneous rocks. The state of Jammu and Kashmir does not possess significant deposits of iron-ore. There are however, some workable iron-ore deposits in the Riasi Tehsil of Udhampur district, in association with the Nummulitic Series, which supported a number of local furnaces for the manufacture of munitions of war during the last two centuries. Still no area of iron-ore has been identified in the Kashmir

and Ladakh divisions of the state. The non-availability of iron-ore is one of the main reasons for the industrial backwardness of the state.

Gold

Gold is one of the rare and precious minerals. It is found in hydrothermal veins in the crust or in alluvial grains, placer deposits and conglomerate. Gold bearing quartz veins have been found in areas of Dras, Suru and Indus Valley in the Kargil and Leh districts of Ladakh Division. The gold found in quartz veins gets exposed under the impact of weathering and may be transported by running water. In fact, particles of gold have been noted as placer deposits in the course of rivers and streams of Ladakh and the terraces of Indus River. Gold has been traced in conglomerate deposits in the valleys of Dras, Suru and Indus, forming a contiguous deposit, ranging in thickness from one metre to four metres. It is estimated that 0.6 gram of gold can be obtained per cubic metre of conglomerate in Ladakh. Alluvial gold washing is carried on in the sands and gravels of many of the tributaries of the Indus River.

Copper:

Copper is extracted from the ore of chalcopyrite which is found in rocks like serpentinite, diorite, chlorite schist and slates. Chalcopyrite a double sulphide of copper and iron is the main copper-ore found at Sumbhar (Anantnag), Lashtial (Baramulla) and Ganderbal. In Ladakh region native type of copper has been reported from areas of Zaskar. Investigations about the occurrence of copper in Doda District have also been started. It is hoped that copper-ore in all the quartz veins of quartzite rocks of the Doda District have appreciable quantities of copper which may be extracted economically.

Lead:

Lead does not occur in nature as the native metal, yet it has been known to man since the earliest times because of its easy extraction from the ore. It is a mineral of great economic importance as it is used largely in numerous industries. The main ore of lead is galena. It is found in hydrothermal veins. Galena is a grey coloured mineral. It has shining metallic lustre, relatively soft and very heavy, often crystallizing in nearly perfect cubes. Galena and other ores of lead are found in association with slate, phyllites graphite-schist and limestone near Ramsu (Jammu Division). About one million tonnes of galena has been estimated in the Ramsu region of the Doda District. In the Division of Kashmir, galena deposits have been reported in Buniyar (Baramulla). The ore of Buniyar deposits may yield 30 to 70 per cent of lead. Several parts of side-valleys of Kashmir are being investigated and there is a strong possibility of lead deposits in the Panjal Trap formations.

Bauxite:

Bauxite is a residual deposit formed under special climatic conditions. It is a mixture of hydrated aluminium oxides, but the name is applied particularly to varieties of the rock laterite rich in hydroxides of aluminium which are the chief ores of the mineral. Bauxite is a mineral of great economic importance. Being light and resistant, it is used mainly in aircraft industry. In the state of Jammu and Kashmir extensive deposits of bauxite are found in Chhakar (Riasi), near Songmarg, Salal, Panhasa, Baladanu, Sangmarg, Sukhwal-gali and Khander in the districts of Rajauri and Udhampur. The Geological Survey of India has estimated about 12 million tonnes of bauxite in these fields and the analysis has revealed that the ore contains 60 to 70 per cent of alumina. In 1994-95, the production of bauxite was over 2125 tonnes. A calcined bauxite unit set up by the Kashmisa Industries at Jammu, started production in 1983.

Chromium:

Chromite is used in the manufacturing of refractory bricks for furnace-linings. Its chief metallurgical use lies in its being the raw material of chromium. An alloy of chromium and iron (ferro-chrome) is used in the making of rustless and stainless steels and armour plates. A large amount of chromium is used in the manufacture of mordants and pigments, because of the red, yellow, and green colours of its salts. The main ore for chromium is the chromite which is found in ultra-basic igneous rocks and serpentinites. The chromite ore occurs usually as brown or black crystal. In the state, chromite deposits are found in the cretaceous volcanics of Burzil, Dras, Bumbat, Tashgam, and Kargil Valley of Ladakh. It is mainly used in metallurgy.

Zinc:

Zinc is obtained from the zinc sulphide and zinc blend. The mineral is found usually in limestone and veins associated with copper and lead ores. Zinc is found in Buniyar area in association with galena, chalcopyrite and pyrites. Zinc ore is also found in limestone's deposits of Udhampur.

Sapphire:

Sapphire is a blue transparent or translucent corundum (gem). It is naturally occurring oxide of aluminium and contains as much as 52 per cent of aluminium. In India, Jammu and Kashmir is the only state in which sapphire deposits of good quality are found. The famous sapphire mines of poddar near Sumjam in Kishtwar are located at an elevation of 4,500 m in the upper reaches of Chenab River in the Doda District. In Kishtwar sapphire was discovered in 1882, and since then mining has been going on intermittently. The precious stone is inter-bedded in the rocks of Salkhala Series and is associated with meta-basic, intruded by a number of pegmatite and quartz veins. The sapphire bearing portions are lenticulars composed of plagioclase, feldspars, tourmaline and corundum. The precious stones occur as small prism of 5

mm width and show pyramidal structure. Transparent crystallized corundum occurs in pegmatite veins cutting actinolite-schist lenticles in Salkhala marble at an altitude of 4,500 m. Associated minerals in the pegmatite are prehnite, tourmaline, beryl, spodumene and lazurite. The Mineral Survey of Kashmir has revealed a large quantity of crystallized transparent corundum. The bulk of the output from the mines is confined to what are called 'rock sapphires' valueless for gems and of use as abrasives, watch jewels, etc.

Ruby:

Ruby is red transparent variety of corundum (gem.) It is found in the areas of Zanskar, Sumjam and Poddar in association with sapphire bearing rocks. Ruby occurs in meta sediments and meta-basic intruded rocks such as quartz and pegmatites. A highly productive locality for aquamarines was discovered in the Kashmir Valley in Skardu, whence crystals of considerable size and purity were recovered. The gem occurs in coarse pegmatite veinstraversing biotitegneiss.

Tourmalines:

Pellucid and beautifully coloured varieties of tourmaline, red, green or blue, are worked as gems. The green variety known as indicolite occurs in the Poddar area of Kashmir where also some transparent crystals of rubellite are found. The latter tourmalines possess greater transparency, but are much fissured. The Geological Survey of India is exploring new sites in the Doda district of Jammu to discover tourmalines. Besides the above named varieties, other crystallized minerals, when of fine colour and attractive appearance and possessing some of the other qualities of gems, e.g., hardness, transparency, etc., are cut for ornamental purposes in Kishtwar, Doda, Kashmir, Ladakh. Turquoise, opaque, of fine blue colour, usually uncut which is commonly sold in Srinagar is a product of Tibet, or Ladakh. Gem-cutting industry has great potential in Kishtwar, Srinagar, Jammu, Leh and Kargil. There are numerous other non-metallic minerals found in the state, most of which are bedded deposits.

Bentonite:

Bentonite is especial assemblage of clay mineral, in many instances formed by weathering of acid, lavas and pyroclastic rocks. The deposits of bentonite are spread between Bhimber and Kathua in the Jammu Division. These deposits lie, on the gentle dipping slopes of the outer plains of Jammu. Para, Chittopali, Modkali, Uttar Bhimber Bazar and Panipur are the areas of Jammu Division in which bentonite is found. From Bhimber to Kathua there is a continuous bed of bentonite deposit running for a length of about 10 km and about half a metre thick occupying a definite horizon in the Upper Siwaliks. Bentonite is used for cleaning grease spots, soap making, ceramics plaster, and filling paper, washing silk and cotton clothes. It is also known as 'Serati Mitti'.

Kaolinite (China Clay):

Kaolinite is a clay produced by the decomposition in-situ of the felspar. It is the natural (unwashed) china clay. Kaolinite is found in association with bauxite deposits of Jammu. It occurs between great limestone and breccia and nummulitics and coal measures of bauxite series of the Salal, Songarmar and Chakar areas. The local name of the mineral is Makol. It is used for white-washing purposes. Kaolinite deposits are available upto a thickness of one to four metres in the areas of its occurrence which can be used effectively in pottery making.

Borax:

Borax is deposited as a result of evaporation of hot spring water. It is of use in the manufacture of superior grades of glass, artificial gems, soaps, varnishes and soldering and enameling. Ladakh is the only part of the country in which borax is found. In the form of surface deposits, borax is found in the Puga Valley and Chumathang of the Maheyang area of Ladakh. Annually about 15 tonnes of borax is obtained from these places. There is a project to refine the large reserves of crude borax in the Puga Valley lakes locally and to transport the product by aircraft to the industrial centers of India.

Gypsum:

Gypsum forms large bedded masses or aggregates occurring in association with rocks of a number of different geological formations. Millions of tonnes of gypsum, the alteration product of pyritous limestone of Salkhala age, are laid bare in the mountains of Uri and Baramulla area of Kashmir in a stretch of about 40 km along the strike. Gypsum is an evaporite mineral found in clays and limestone's, sometimes associated with sulphur. It is an important nonmetallic mineral of great economic importance. It is a hydrous sulphate of calcium. Snow-white gypsum with intercalation of quartzite and schists is found in areas of Uri, Ramban, Assar, Batote. The industrial use of gypsum is in the manufacture of synthetic fertilizers, plasters, distempers and in the cement factory. It is also used as a surface-dressing for lands in agriculture, and as a fertilizer, with considerable benefit to certain crops. Gypsum has begun to be used as a source of sulphur in the manufacture of fertilizers. Gypsum mined near Uri is supplied to the Wuyan Cement Factory of Srinagar (Kashmir). Ramban and Assar fields have gypsum deposits of about 19 and 5 million tonnes respectively.

Magnesite:

Magnesite is a mineral of the carbonate group. It is found in irregular veins in serpentine and formed by replacement of dolomite and limestone. In the state of Jammu and Kashmir, magnesite is found in Shergol (Leh-Kargil Road). The recent researches by Rana (1975), Chadha (1978) have discovered good deposits of magnesite in and around Katra (Udhampur) area of the Jammu Division.

Sulphur:

Sulphur is a mineral obtained from iron pyrite or in the neighbourhood of volcanic regions. It is also associated with limestone's, sandstones and salt domes. In the state of Jammu and Kashmir, sulphur is found in areas of recent volcanic activity, around hot springs. Substantial deposits of sulphur have been located in the Puga Valley of Ladakh Division. The Geological Survey of India has estimated are serve of about 6,000 tonnes of sulphur in the Puga Valley.

Limestone:

Limestone is a carbonate of calcium. Besides, its uses as building stones, and as lime and cement raw material, lime stones, if of the required purity, have important uses in the chemical, alkaline, sugar and metallurgical industries. It is found in Manasbal, Bern, Achabal, Barwar, Verinag, Wuyan, Jan- galgali, Salal, Riasi, Basohli, Kalakote and Khalsi (Ladakh).

Slates and Phyllitics:

Slates and phyllites are the metamorphic rocks of great economic importance. Slate is obtained from the vicinity of Banihal, Ramban and Ramsu. It is being used successfully for roofing. In Marpathri near Gulmarg about ten million tonnes of good quality of roofing slate has been estimated by the Geological Survey of India.

Mineral Paints:

A number of rock and mineral substances are employed in the manufacturing of paints and colouring materials. Substances which are suitable for this purpose include earthy forms of hematite and limonite (ochre, geru), refuse of slate and shale quarries, possessing the proper colour and degree of fineness; graphite; laterite, orpiment; barytes, asbestos, mica, steatite, etc. Large quantities of red and yellow ochre in association with graphite-bearing slate occur in the Salkhala System of deposits in the Uri Tehsil of the Baramulla District of Kashmir Division.

Sand and Bajri

Quantities of sand, pebbles and shingles are available in the Chenab and Tawi rivers and the numerous Nallas and hilly torrents of the state. Sandstones are in abundance along the Jammu-Srinagar National Highway and the Jammu Punch Road in the Siwaliks and Murree tracts which are being used for building materials. Mineral resources as discussed are exhaustible and therefore, should be used judiciously. The exploitation and conservation of mineral resources largely depends on the technological stage, the location of mineral ore with reference to transport and market. The exhaustible mineral resources deserve special attention. A scientific policy about their exploitation and utilization needs to be formulated.

Minerals Conservation and Environmental Protection:

Extraction of minerals is our economic necessity. Our economic structure which is quite complex hinges on industries. These industries draw their raw materials from minerals, forests and agriculture. The large-scale and heavy industries, economic and commercial activities are largely dependent on minerals and metals. The process of extraction of mineral resources and its use in various ways generate a wide range of environmental changes—sometimes having far reaching consequences. While these wasting assets have evoked formulation of national policies for their proper conservation, little has been done to ensure rehabilitation of land adversely affected by mining activities. Since we cannot sustain our economy and society without industrial development, it is imperative to utilize the resources judiciously and to manage the mining industry scientifically. The damage caused to the environment may be reduced if the following steps are taken by the government, the contractors and the people who are directly or indirectly involved in the mining industry.

- 1) There should be a legislative provision for full responsibility of treatment and environmental rehabilitation on excavated areas squarely on the mining agencies. There should be legal binding on the mine owners to restore the land they have damaged.
- 2) There must be compulsion for stacking and preserving top soil in order to cover back the excavated parts with debris produced and then put a cover of soil over it so that crops and grasses may be grown over it.
- 3) There should be incentives for successful programmes of land restoration, soil conservation and afforestation.
- 4) There should be serious attempts to stabilize the slopes, not only during the excavations but also afterwards to ensure that stability is maintained in future also. For this purpose, there should be construction of drainage network, and retaining walls.
- 5) There should be restriction on mining in the geo dynamically sensitive and ecologically fragile parts of the mountains.
- 6) Deeper excavation on the surface or underground digging causes the water table to sink locally, resulting in the wells and springs of the vicinity going dry. Mining of limestone, etc., in the neighborhood of towns and villages therefore should be restricted.
- 7) The miners should be provided safe drinking water by the mine-owners.
- 8) The deep depressions formed by deep mining can be converted into lake to develop picnic spots or they may be used for dumping municipal and industrial wastes. These waste dumps may be subsequently covered with topsoil and afforested.
- 9) There should be more research to develop the new technology for the optimal extraction of minerals which may be ecofriendly.
- 10) There should be environmental awareness among the masses who can help in the restoration of the degraded mining tracts

III. Lithium Reserves in Salal-Himania

When your cars need juice, lithium is the thing to use. The days of petrol and diesel cars are numbered. In a decade or so their sale will be minimised and might be banned as of 2035-40 in most of the metropolitan cities as lithium has the power to offer this change and electric cars will become the norm. Since, EVs run on lithium batteries, each containing about 10 kilos of the metal, the future of any region will depend upon this white gold and Jammu and Kashmir is the luckiest one as we too are about to join this white gold rush. The Government has made a historic discovery in the mineral-rich region of Jammu and Kashmir, for the first time ever, the country has found lithium deposits in this area. According to the Mines Ministry, the Salal-Haimana area of Reasi District has approximately 5.9 million tonnes of lithium reserves. This information was revealed recently during the 62nd meeting of the Central Geological Programming Board (CGPB).

The lithium deposits found in Jammu and Kashmir are the first of such deposits discovered in India and are expected to give a major flip to the country's self-sufficiency in Electric Vehicle (EV).

A non-ferrous metal, lithium is one of the key components used in EV batteries for electric vehicles. Till now India used to import lithium required for EV Battery production but now this discovery could lead to not only a reduction in India's dependence on foreign countries but also bring down the cost of such batteries in the future. The discovery is likely to make India truly 'Atmanirbhar' while also creating jobs, generating revenue, and furthering its renewable energy ambitions.

Not only EVs batteries; Lithium has a broad range of other uses in our modern world, encompassing both chemical and technical applications. It is used to make soap and lubricant greases, to produce heat resistant glass and ceramics such as stove tops, and to manufacture aircraft. It is also used to make fireworks: lithium mixed with strontium salts and other chemicals creates a vibrant red colour upon combustion. A lesser-known application of lithium today is as a treatment for mental health issues. Lithium carbonate, most often sold as a pharmaceutical, is a common treatment of bipolar disorder and manic depression, helping stabilise and boost mood. Studies have even found that lithium in drinking water correlates with lower levels of suicide, although psychiatrists are careful about prescribing lithium in high doses, due to unknown effects it can have on the body.

Thus the discovery of lithium deposits in J&K is a positive step for the state and lithium has a bright future in India. Surging demand, driven primarily by the use of lithium batteries, plus an abundant supply and adequate infrastructure in place to mine this resource means we are well placed to reap the benefits of lithium over the next decade or so. Thus, it has the potential to drive economic growth and boost the country's mineral resources and thereby the economy of the country on the whole.

But a million dollar question to ponder over is, from time immemorial, the mineral resource sector has played a vital role in the world economy and human development; Will the Mineral riches be really good for J&K too? Will 5.9 Million Tons of Lithium reserves change the economy of Jammu and Kashmir and especially the future of residents of Reasi District?

Usually the minerals mining industry supports a good number of jobs and metal mining jobs are one of the highest paying in the private sector. Prospects are thus bright for the unemployed youth who choose entering the field but only when preference will be given to locals who are already facing unemployment pangs. Therefore, lithium mining is critical for our economy as well.

Other good things associated with the mining in the region will be the infrastructural, technological and productivity gains that will also transform other sectors. Thus, the Lithium reserve of Jammu and Kashmir is a Jackpot for the Indian economy on the whole and is set to boost the economy and future development of Jammu and Kashmir in general and that of Salal-Haimana area of Reasi District in particular as well.

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