

# Investigation Study of Minerals - Non Renewable Energy Resources and Effects of Their Mining on Environment and Indian Economy



## Engineering

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### ABSTRACT

— In this present paper a case study has been discussed regarding the harmful effects of mining of minerals. In Mussoorie, it was observed that a place with vibrant flora and fauna was one of the main tourist attractions. It was also known as the queen of hills. But due to the initiation of lime stone quarrying, the hill station virtually lost its age-old wealth of trees, faunas, pastures, springs and animal husbandry. Although the situation is now slowly reversing with the ban on quarrying imposed by the Supreme Court. Before the case study an investigation has been done regarding minerals, the renewable energy resources and the process of getting those minerals i.e. mining. It has been discussed that mineral resources are non-renewable resources and almost all the countries in the world are quite dependent on them. Moreover, the process of mining is a job that puts not just the lives of the workers at risk but even disturbs the flora and fauna of that particular region. Conservation of minerals, its importance and the importance of minerals itself has also been highlighted. A mild touch of the different types of mining has been studied. A future without minerals can be considered to be very cruel but that is something, which is inevitable if we continue to exploit these mineral resources in such a way. Even though the mining sector of a country is considered to be the backbone of its economy but this does not change the fact that the mining sector is something that is very unsafe. The impact of mining is far from worse to the environment; the case of Mussoorie clearly says its story. So saying that mining is something that should be partially banned and good substitutes of these mineral resources should be used can conclude it.

(i) **Minerals** are the most common solid material found on earth. The earth's land and oceans all rest on a layer of rock made up of minerals. All rocks found on earth's surface also contain minerals. Even soil contains tiny pieces of minerals broken from rocks. There are about 3000 kinds of minerals but only about 100 of them are common. Most of the others are even harder to find than gold. Mineralogists use the term mineral to define a substance that has four following features: -

1. A mineral can be found in nature.
2. A mineral is made up of a substance that was never known.
3. A mineral has the same chemical make up wherever it is found.
4. The atoms of a mineral are arranged in a regular pattern. A mineral can be as hard as diamond and as soft as gypsum.

Main Characteristics of minerals are -

1. Luster
2. Cleavage
3. Hardness
4. Color.

Minerals are deposited only during the cooling of earth's crust. Fresh deposits cannot occur except through leaching, sedimentation and volcanic eruptions.

The average abundance of minerals in earth's crust is called Clarke. The body of rock where an ore is present is called host. An ore body is an area in the crust where the mineral occurs in such a concentration where it can be economically exploited. The quantity of mineral present in an ore is known as resource. Steps involved in mineral utilization are: -

1. Extraction of raw ore
2. Processing of raw ore
3. Purification of mineral
4. Conversion of mineral into bulk state.
5. Manufacture of utility goods.
6. Return to environment as refuse or waste.

All the economically important minerals are not found everywhere. India is rich in 35 minerals like Iron, Aluminium (bauxite) Manganese, Chromium, Limestone, Dolomite, and Mica etc. India is deficient in lead, copper phosphate, Potassium, nickel, gold and silver. Mineral extraction of a country is not just related to its own consumption but is also related largely to the exports. Every country is deficient in some minerals and surplus in other Excessive exploitation of minerals is resulting into fast depletion of our mineral resources. Lifetime of several miner-

als is only of few decades. Even the most abundant mineral Aluminium, Iron, Chromium will not last beyond 100 to 300 years. India stands first among the mica producing countries of the world. Bihar contributes almost half of India's mica. Andhra and Rajasthan are also leading mica-producing states. India produces salt from sea and lakes falling in Gujarat, Tamil Nadu, Maharashtra and Andhra Pradesh. The lake salt comes from Sambhar Lake in Rajasthan. India has world's richest deposits of Sillimanite and Kyanite.

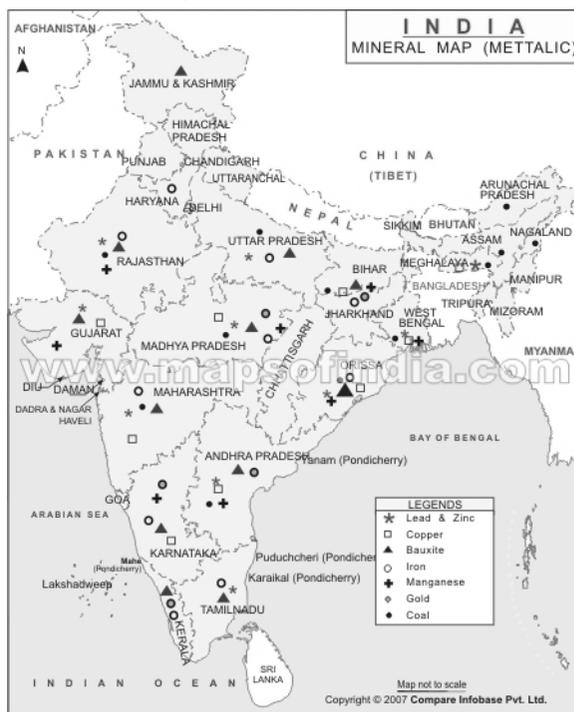


Fig. 1 Metallic Minerals map (Source-www.mapsofindia.com)

(ii) **Conservation of mineral resources:** - We know that mineral resources are limited in quality and are

being depleted very fast. The following steps are now being taken for the conservation of these natural resources.

1. A pplication of efficient method of mining to take out very possible tonnage lying under ground.
2. Utilization of unmarketable ones through the innovative methods or ore dressing and metallurgical practices.
3. Reuse and recycling of metals.
4. Search for new deposits.
5. Recovering all associated elements as co-product or by-product.
6. Economic use of minerals.
7. Substituting the use or rare land costly minerals with those, which are abundant and cheaper.
8. Research is being carried out to substitute some metals like gold, silver, mercury and platinum etc. by man made products.
9. Mining area needs reclamation.
10. A data bank on the availability and expenditure of mineral resources should be maintained so that their use in regulated.
11. Minimizing waste and developing technologies to recover the resources from waste.

**(iii) Important uses of Minerals**

**Non-metal mineral uses**

Silicate minerals- Sand and gravel for construction, bricks, paving etc.

- Limestone- Used for concrete building
- Stone- Used in agriculture for neutralizing acid soils, used in cement industry.
- Gypsum- Used in plaster wall-board, in agriculture
- Potash Phosphorite- used as fertilizers.
- Sulphur Pyrites- Used in medicine, car battery, industry.

**(iv) Mining**

Mining is the process of taking mineral and other substances from the earth. These substances include metal compounds, non-minerals such as coal, sand, oil and natural gas and many other useful things.

Mining provides iron and copper for making vehicles and heavy machinery. Mines also supply salt for food, gold, silver and diamonds for jewellery; and coal for fuel. We mine uranium for nuclear energy, stone for buildings, phosphate for fertilizers and gravel for roads.

Some minerals can be mined more cheaply than others because they are found at the earth's surface. Some minerals lie far beneath the surface and can be obtained only by digging deep underground. Other elements are found beneath the oceans, lakes and rivers.

People have mined the earth for thousands of years. About 6000 B.C. people dug pits and tunnels to get flint, a hard stone used to make tools and weapons. By 3500 B.C. people were mining tin and copper to make bronze a hard alloy.

**Kinds of Mining:** -There are many methods of mining. Each is based on where and how a mineral deposit is found in the earth. Some mineral deposits lie at or near the earth's surface and others are far underground. Some minerals are found at a very specific place and others are widely scattered. Some minerals occur in large bodies such as oceans and seas and are obtained by pumping. Today most mines are highly mechanized.

**(a) Surface mining methods:** -Surface mining methods are used when deposits occur at or near the surface of the earth. These methods include placer mining, dredging, open cast mining, strip mining and quarrying.

1. **Placer mining:** - it is a way of obtaining gold, platinum, tin and other heavy minerals from gravel and sand deposits called placers where nearby water supplies are plentiful.
2. **Dredging:** - It is used especially where mineral bearing

sand and gravel layers are exceptionally thick. In dredging a pond or lake must be formed so that a large barge like machine called a dredge can be floated.

3. **Open cast mining:** - It is used to recover valuable minerals from large, thick ore bodies lying close to the surface. Miners first remove the over burden (rock and materials that cover the deposits) and then ore bearing hard rock is broken up by explosives.
4. **Strip mining:** - It is a method of obtaining coal, phosphate, and other minerals that lie near the earth's surface.
5. **Quarrying:** - It is a way of mining a deposit that lies at the surface of earth. And can be obtained with little or no over burden, e.g. limestone, gypsum and mica mine.

**(b) Underground mining methods:** -These methods are used when the mineral deposit lies deep beneath the earth's surface. Its types are: -

1. **Room and pillar mining:** - It is a method of recovery of ore from horizontal or near horizontal ore bodies.
2. **Long wall mining:** - It is also used to dig ore from horizontal seams.
3. **Sublevel stopping:** - It is used in ore bodies with a steep dip.
4. **Cut and fill mining:** - It is a method of removing ore from vertical veins in horizontal slices, starting at the bottom of the slope and advancing upward.
5. **Block caving:** - It is a way of mining such ores as copper and iron when they are scattered throughout the waste material.
6. **Sub level caving:** - It is used in large steeply dipping ore bodies.

**(c) Pumping methods:** -Pumping methods are used to recover minerals that occur in large bodies of water or/ that can be changed in to liquid form.



**Fig. 2 Pumping to recover minerals (Source-www.minerals.net)**

**(v) Effects of mining:** -Unlike agriculture or forestry, where crops can be grown over and over again, mining is a robber industry. However, large the deposit of a given mineral is, continuous mining will exhaust the ores. The natural replacement of minerals is a very slow process and it cannot compensate the fast process of mineral extraction, and minerals are thus a finite and declining resource. Mining may in the long term have detrimental effects in the form of dereliction when exhausted workings are abandoned. Chief harmful effects of dereliction are: -

1. Accelerated soil erosion of the area in absence of vegetation.
2. Deforestation of area leading to number of detrimental effects of deforestation like floods, low rainfall, soil erosion.
3. Over fishing of the area leading to ecological imbalance.
4. Air pollution of the area - fine dust coming out during mining areas covers the entire area causing different kinds of respiratory problems.
5. Dust covers the entire vegetation of the area, which results in death and decay of plants.

6. Water pollution - ruthless exploitation of mineral resources causes lot of water pollution.
7. Strip mining has earned a bad reputation because it causes great destruction in the mined areas. This is especially true in mountainous areas, where strip mining destroys vegetation on mountain slides and lead to mud slides and severe erosion of the land.
8. Waste of agricultural land, which is a scarce resource.
9. Waste of industrial land.



Fig. 2 (Source-www.minerals.net)

10. Ugliness: - It makes the land look ugly and unpleasant to eyes.
11. Health and accident hazards: - Land over underground mines may subside, causing houses to collapse or creating hummocky ground unsuitable for any use and often full of pools of water. Shafts that are not filled in may lead to accidents and old quarries and open cast pits may also be dangerous.
12. Mining causes permanent damage to landscape.

**Effects of mining on forests:** -In forested and hilly areas mining and quarrying are extremely harmful as they spoil the vegetation over large areas due to mine dust, transport of ore and mine wastes and heavy pollution in the surrounding areas.



Fig. 5 Effects of mining on forests (Source-www.mine.nic.in)

**Combating Derelictions:** -Most derelictions are the results of thoughtless and uncontrolled mineral extraction and processing. Dereliction arises because mining operators are unwilling to spend money on rehabilitation, which will give them no direct financial return. Derelictions and its dangers can be combated by:

1. Reclamation of the land by national or local government agency. Reclamation is a process in which the land is restored as closely as possible to its original state. In many cases the reclaimed land is more valuable than it was before mining. For example, the lakes created in the final cuts of some mined areas have provided excellent fishing and wa-

ter sports.

2. Formulation of plans for reclamation of the land before mining can begin.
3. Legislation forcing existing mining companies to rehabilitate land after it becomes uneconomic to extract the mineral.

**Effects of mining on the economy:** -Mining and the processing of minerals inevitably have effects on the economies of areas with large or valuable mineral resources.

1. They provide employment opportunities. In some areas especially tribal areas this may be more important than others, depending upon the numerous other opportunities available.
2. They stimulate the development of transport links to places, which might otherwise be inaccessible.
3. Population may move to mining sites and thus settle hitherto underdeveloped parts of a country.
4. Export earnings may be increased, especially in developing countries.
5. Domestic industries associated with the metals may be stimulated in agricultural (rural) and little industrialized areas.
6. Mining may in the long term have detrimental effects in the form of dereliction when exhausted workings are abandoned.
7. Decline in mining activity may leave areas of a country depressed with problems of unemployment and declining industry.
8. Mining has adverse effects on human health- It causes silicosis, eye problems many serious lung problems.
9. Mining affects the plants growing in the area by dogging their stomata pores-and causing injury. Plant growth is adversely affected due to abundance of few elements and lack of some other elements. It makes reforestation efforts useless.

#### Case study: -(Mining in Mussoorie hills)

Mining covers over a 1,00,000 hectares in India. Waste generated by mining destroys vegetation and disrupts water supply of that area. Mussoorie, the queen of hills had thick forests both on the slopes (fir, birch, pine and oak) and the sides of riverbeds (Shorea, Delbergia) with a number of diverse kinds of animal population. Animal husbandry was popular. There were a number of springs feeding streams like Derinala. Kakbari, kempty falls etc. With the initiation of lime stone quarrying, the hill station virtually lost its age-old wealth of trees, faunas, pastures, springs and animal husbandry. Landslide became frequent. The situation is now slowly reversing with the ban on quarrying imposed by the Supreme Court.



Fig. 5

Case of mining in scrub forests present on Gwalpahari, which falls between Gurgaon and Faridabad districts of Haryana, also needs a special mention here. Mining has resulted in destruction of natural topography of Aravalli hills present in the area.

Health of vegetation and human population including workers of mines are being affected adversely. Afforestation efforts of the area are being hampered by large amount of Badarpur dust present in the area. Recently, Supreme Court has banned the mining in the area.

### Conclusion and Future Scope

Minerals and mining sector contributes significantly to the economic growth and development of India in the form of exports, raw material to other industries in the country and finally vast employment opportunities and a high rate of wages. The Indian mining industry currently employs over 1.1 million people and offers a wide range of opportunities to mining engineers in the public as well as private sector. The government offers a wide range of concessions to investors engaged in the mining activity. India is the world's largest producer of mica; third-largest

producer of coal and lignite; and also ranks among the top producers of iron ore, bauxite, manganese ore and aluminum. The availability of cheap labor for the industry is a major attraction to the global players. India has around 20,000 known mineral deposits and the geological potential in this regard is very substantial. There are over 2,326 private and 292 public operating mines in India, and the minerals and metals from these mines contribute about 16 percent to India's total exports.

Mining industry is booming in India but the difficult question that cannot be answered by any top personnel of this industry is that what happens after we exhaust all our mineral resources and what happens to the wildlife and ecosystem of that place where the extraction of minerals takes place.

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