



Ch. – 7 – Lecture Notes

Geography

“Mineral And Energy Resources”

Introduction

- **Minerals are an indispensable part of our lives.** Almost everything we use, from a tiny pin to a towering building or a big ship, all are made from minerals.
- The railway lines and the tarmac (paving) of the roads, our implements and machinery too are made from minerals.
- Cars, buses, trains, aeroplanes are manufactured from minerals and run on power resources derived from the earth.
- Even the food that we eat contains minerals. In all stages of development, human beings have used minerals for their livelihood, decoration, festivities, religious and ceremonial rites.

What is a mineral?

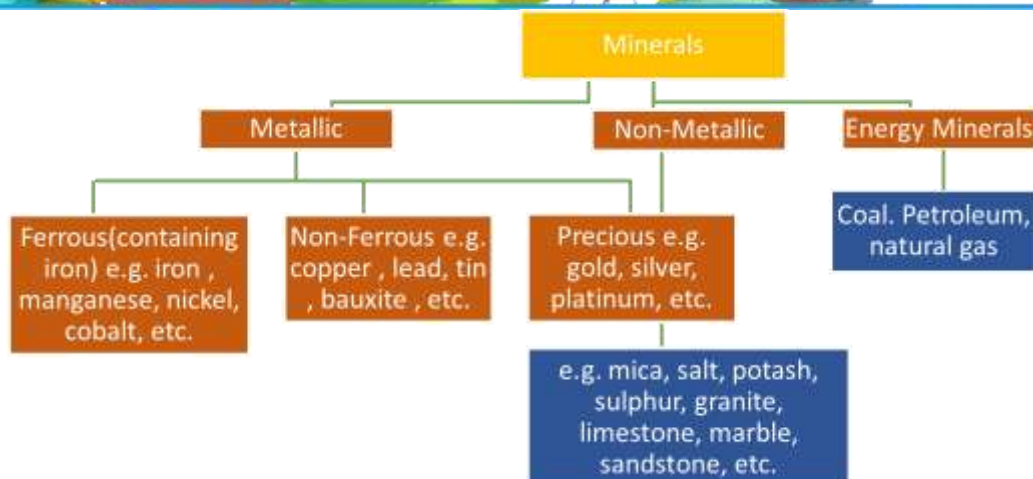
- **Geologists define mineral as a “homogenous, naturally occurring substance with a definable internal structure.”**
- Minerals are found in varied forms in nature, ranging from the hardest diamond to the softest talc.

• Importance of Mineral Resources:

- They are essential for industrial and economic development of nations.
- Copper, tin & iron ore were essential to the ancient metal-using cultures of the Bronze & Iron Ages.
- They are used in construction, engineering and chemical industries.
- Minerals like coal and petroleum are also the main source of power.
- Life processes cannot occur without minerals.
- Although our mineral intake represents **only about 0.3 per cent of our total intake of nutrients**, they are so potent and so important that without them we would not be able to utilise the other 99.7 per cent of foodstuffs.

• Classification of Minerals

- **Rocks are combinations of homogenous substances called minerals.**
- Some rocks, for instance limestone, consist of a single mineral only, but majority of the rock consist of several minerals in varying proportions.
- **Although, over 2000 minerals have been identified**, only a few are abundantly found in most of the rocks.
- A particular mineral that will be formed from a certain combination of elements depends upon the physical and chemical conditions under which the material forms.
- This, in turn, results in a wide range of colours, hardness, crystal forms, lustre and density that a particular mineral possesses.
- **Geologists use these properties to classify the minerals.**



1. **Metallic Minerals:** Metals are extracted from these minerals. Metallic minerals further be divided into Ferrous and Non-Ferrous.
 - (i) **Ferrous minerals:** The minerals which contain Iron ore are called ferrous minerals. e.g. Iron Ore, Nickel, Cobalt etc.
 - (ii) **Non-Ferrous minerals:** Minerals containing metals other than iron ore are known as non-ferrous minerals e.g. Gold, Silver, Platinum etc.
2. **Non -Metallic Minerals:**
 - (i) **Precious minerals:** The minerals which have very high economic value are known as Precious minerals e.g. Gold, Silver etc.
 - (ii) **Energy minerals:** The minerals which provide energy or power are known as energy minerals. e.g. Coal, Petroleum, Natural gas etc.

• Where are these minerals found?

- Minerals are usually found in “ores”.
- **The term ore is used to describe an accumulation of any mineral mixed with other elements.**
- The mineral content of the ore must be in sufficient concentration to make its extraction commercially viable.
- The type of formation or structure in which they are found determines the relative ease with which mineral ores may be mined. This also determines the cost of extraction.

• MODE OF OCCURENCE OF MINERALS

- (a) **Minerals in igneous and Metamorphic rock:** The minerals are found in crevices, faults or joints. The smaller occurrence is called veins and larger lodes. In most cases, they are formed when minerals in liquid/molten/gaseous form are forced upwards through cavities towards the earth's surface. They cool and solidify as they rise. Major metallic minerals like Tin, Copper, Zinc and Lead etc are obtained from veins and lodes.
- (b) **Minerals in decomposed rocks:** This involves the decomposition of surface rocks, and the removal of soluble constituents, leaving a residual mass of weathered material containing ores, Bauxite is formed this way.



- (c) **Minerals in alluvial deposits:** Certain minerals may occur as alluvial deposits in stands of valley floors and the base of hills. **These deposits are called "Placer deposits"** and generally contain minerals which are not corroded by water. e.g. Gold, Silver, Tin etc.
- (d) **Minerals in sedimentary rocks:** In sedimentary rocks a number of minerals occur in beds or layers. **They have been formed as a result of deposition, accumulation and concentration in horizontal strata.** Coal and some forms of iron ore have been concentrated as a result of long periods under great heat and pressure. Gypsum, salt, Potash and Sodium salt are formed as a result of evaporation especially in arid regions.
- (e) **Minerals in ocean water:** The minerals which are formed in ocean water are called ocean water minerals e.g. **Common Salt, Magnesium and Bromine are largely derived from ocean water.**

• DISTRIBUTION OF MINERAL RESOURCES

- India is fortunate to have fairly rich and varied mineral resources. However, these are unevenly distributed. The differences in the distribution has occurred due to the following reasons:
 1. Differences in their geological structure
 2. Time involved in the formation of minerals.
 3. Processes
- (i) **Minerals in Deccan region:** The peninsular rock contains most of the reserves of coal, metallic minerals, mica and many other non-metallic minerals.
- (ii) **Minerals in western and eastern region of India:** Sedimentary rocks of the western and eastern parts of India. i.e., Gujarat and Assam have most of the petroleum deposits.
- (iii) **Minerals in Rajasthan:** Rajasthan with the rock system of the peninsula, has reserves of many non-ferrous minerals.
- (iv) **Minerals in North India:** North India is almost devoid of economic minerals.

• Minerals to Mines

- **"Mineral Deposit" turns into a "Mine" when** there is sufficient concentration of mineral in the ore. The case of extraction. Closeness to the market.

• Rat Hole Mining

- In tribal areas of north-east, minerals are owned by individuals or communities.
- In Meghalaya there are large deposits of coal, iron ore, limestone and dolomite etc.
- **Coal mining in Jowai and Cherapunjee is done by family member in the form of a long narrow tunnel, known as 'Rat hole' mining.**

FERROUS MINERALS

- They provide a strong base for the development of metallurgical industry and accounts for **about 3/4th of the total value of the production of metallic minerals.**

Iron Ore

- Iron ore is the basic mineral, considered to be the backbone of industrial development.
- India is rich in good quality iron ore.
- **Types of Iron Ore**
 - (i) **Magnetite:** This is the best quality of iron ore and contains about 70% iron. It has excellent magnetic qualities, especially valuable in the electrical industry.
 - (ii) **Haematite:** It is most important industrial iron ore in terms of quantity used. It contains 50% to 60% of pure Iron. e.g. Siderite, Limonite



- **Distribution of iron ore belts in India are:**

- **Orissa – Jharkhand belt:** In Orissa high grade haematite ore is found in Badampahar mines in the Mayurbhanj and Kendujhar district.
- In Singhbhum district of Jharkhand haematite Iron ore is mined in Goa and Noamundi.
- **Durg-Bastar-Chandrapur Belt:** This belt lies in Chhattisgarh and Maharashtra. Very high grade haematite are found in Bailadila range of hills in the Bastar district.
- It has the best physical properties needed for steel making. Iron ore from these mines is exported to Japan and South Korea via Vishakhapatnam, port.
- **Bellary Chitradurga – Chik Manglur – Tumkur Belt is in Karnataka –** The Kudermukh mines, Karnataka are a 100% export unit, known to be one of the largest in the world. The ore is transported as slurry through a pipeline to a port near Mangalore.
- **Maharashtra-Goa belt:** The belt includes the state of Goa and Ratanagiri district of Maharashtra. The ores are not of very high quality. Iron ore is exported through Marmagao port.

- **Manganese**

- **It is mainly used in the manufacturing of steel and ferro-manganese alloy.**
- It is also used in manufacturing bleaching powder, insecticides and paints.
- **It increases the strength of steel.**
- It is also used for making glass and chemical.
- India is one of the leading producers of Manganese.
- Manganese of India is of high quality and is in great demand.
- Japan is the leading importer of India's Manganese.
- **Distribution:** Maharashtra, Madhya Pradesh, Orissa, Karnataka and Andhra Pradesh.
- **Largest producer:** Orissa has one third of the country's total production.

NON-FERROUS MINERALS

- **Copper**

- The physical properties of copper make it valuable to industry.
- Being malleable, ductile and a good conductor. It is mainly used in electrical cables, electronics and chemical industry.
- **India is critically deficient in the reserve and production of copper.**

- **Uses:**

- It is useful in cooking utensils, products and refrigerators.
- It is used in ranging from rain gauges to electronic system for rockets.
- **Large amount of copper wires are used in various kinds of electrical equipment.**

- **Areas of Distribution**

- Madhya Pradesh: 52% (Balaghat mines)
- Jharkhand: Singhbhum, Hazaribagh and Chaibua
- Rajasthan:
 - Along the Aravali range
 - Khetri – Singhana belt in Jhunjhunu.



- **Bauxite**

- Bauxite is the main ore of aluminium.
- Bauxite deposits are formed by the decomposition of rock rich in aluminium silicates.
- **A clay like substance called Alumina and later Aluminium is obtained from Bauxite.**
- Its various properties includes:
 - (i) It has strength.
 - (ii) Lightness.
 - (iii) Good conductivity.
 - (iv) Malleability, therefore it is very important.

- **Uses**

- It is a good conductor of heat and electricity.
- It is used to make cans for various beverages.
- It can be pressed into a thin foil.
- Because it is light and strong, it is used in space craft.
- The bodies and parts of some automobiles are made from aluminium alloy.

- **Areas of Distribution**

- Amarkantak plateau, Maikal hills and plateau of Bilaspur/Katni.
- **Orissa has 45% of country's deposit at Panchpatnali in Karpur district are important Bauxite deposit in this state.**
- Orissa was the largest producing state in India 2018-2019.

Non-Metallic-minerals

- **Mica**

- It is a non-metallic mineral.
- **India is the largest producer of mica** and it produces more than 60% world's mica.
- Its main properties and uses includes:
 - (i) It is made up of a series of plates or leaves.
 - (ii) It can be converted into thin sheets.
 - (iii) It can be black, green, red yellow or brown.
 - (iv) It has excellent di-electric strength, low powerless factor, insulating properties and high resistance.
 - (v) It is indispensable minerals used in electric and electronic industries.

- **Areas of Distribution**

- Northern edge: Chhota Nagpur Plateau, Koderma, Gaya-Hazaribagh belt of Jharkhand.
- Rajasthan: Ajmer
- Andhra Pradesh: Nellore Mica belt.



Rock Minerals:

- **Lime stone:**

- It is associated with rock mineral found in association with calcium or calcium carbonate and magnesium, or mixture of these two, magnesium carbonate in the sedimentary rocks of most geological formations.
- **It is found in sedimentary rocks.**
- It is used for variety of purposes.
- It is a basic input in cement industry.
- It is also used in chemical, iron and steel industry.
- Its major areas of distribution includes: Madhya Pradesh, Andhra Pradesh, Rajasthan, Tamil Nadu and Gujarat.

Hazards of mining

- Mining can be very hazardous.
- The dust and poisonous fumes inhaled by the miners can cause pulmonary diseases.
- Coal mines can catch fire, can get flooded with water & even a roof can collapse.
- Due to dumping of waste & slurry from the mining, the water sources can get polluted & degraded.

- **Preventing Measures**

- Stricter safety regulations.
- Implementations of environmental laws are essential to prevent mining from becoming a Killer Industry.

Conservation of minerals

- **Minerals are considered as the back bone of an economy.**
- Most of the minerals are non-renewable.
- So, there is urgent need for their conservation:
 - (i) The total volume of workable minerals is a very small percentage of the earth's crust.
 - (ii) We are consuming minerals very rapidly whereas it takes millions of years for their replenishment.
 - (iii) Mineral resources are finite & non-renewable.
 - (iv) Continued extraction of ore leads to higher cost as the quality decreases as we move to greater depths.

- **Measures to conserve the minerals**

- Minerals should be used in a planned and judicious way, a concerted effort.
- Wastage of minerals should be minimised.
- Modern technology should be used for the exploitation of minerals.
- **Export of minerals should be minimised.**
- We should think about the use of substitutes in order to save minerals.
- We should encourage recycling of metals.

Energy resources:

- The resources which are used for generating energy are known as energy resources e.g. Coal, Petroleum etc.



Classification of energy resources

- Energy can be generated from fuel minerals like coal, petroleum, natural gas, uranium and from electricity.
- Energy resources can be classified as conventional and non-conventional sources.
- According to one estimate more than 70 per cent energy requirement in rural households is met by these two; continuation of these is increasingly becoming difficult due to decreasing forest area.

Conventional energy resource:

- Conventional power resources are those which are exhaustible.
- Once they have been used up, they cannot be replaced e.g. coal, petroleum.
- They are very costly and causes pollution.
- **These are going to last just for 100 – 200 years.**
- These are non-renewable source of energy e.g. coal, Petroleum, uranium.

• Coal

- Coal is the most abundantly available fossil fuel.
- Its uses includes:
 - (i) Coal provides a substantial part of the Nation's energy need.
 - (ii) It is used for power generation.
 - (iii) India is highly dependent on coal for meeting its commercial energy requirements.
 - (iv) Raw material in industries.
 - (v) Domestic needs.
- **Coal is formed due to compression of plant material over million of years.**

• Varieties of Coal

- Coal is formed in a variety of forms depending on
 - (i) the degrees of compression, (ii) the depth and (iii) time of burial.

• Bituminous coal

- Most popular coal specially used commercially for smelting iron in blast furnace.
- Coal that has been buried deep and subjected to increased temperatures is bituminous coal.
- **Metallurgical coal is high grade bituminous coal** which has a special value for smelting iron in blast furnaces.

• Lignite

- Lignite is a lower grade brown coal which is soft with high moisture content and **contain about 60% carbon.**
- Ash residue is less.
- It is found in Rajasthan, Naveli of Tamil Nadu, Hakhimpur of Assam and Karewa of Jammu & Kashmir.

• Peat

- **This is the first state of transformation of wood into coal.**
- It burns like wood, gives less heat, emits more smoke and leaves a log of ash after burning.
- Formed due to decay of plants in the swamps. It has low carbon, high moisture & low heating capacity.



- **Anthracite Coal**

- This is the best quality hard coal having the highest calorific value.
- It is found only in Jammu Kashmir and that too in small quantity.

- **Classification of Coal field in India**

- In India coal occurs in the rock series of two geological ages.

1. Gondwana coal field

- **Gondwana coal is over 200 million years in age.**
- Gondwana coal metallurgical coal is located in Damodar valley (West Bengal, Jharkhand). Jharia, Raniganj, Bokaro, Godavari, Mahanadi, Son and Wardha Valleys.

2. Tertiary coal field

- **The Tertiary rock system bears coal of younger age** which are only about 55 million years old and are mainly confined to the extra peninsula.
- Important area of tertiary coal includes parts of Assam, Meghalaya, Arunachal Pradesh, Nagaland.

Petroleum

- Petroleum or mineral oil is the next major energy source in India after coal.
- The word 'petroleum' has been derived from two Latin words, Petra (meaning rock) and oleum (meaning oil).
- Thus, petroleum is oil obtained from rocks, particularly sedimentary rocks of the earth.
Therefore, it's also called mineral oil.
- Petroleum is an inflammable liquid that is composed of hydrocarbons.

- **The uses of petroleum are:**

- It is the major source of power for vehicles.
- It provides the most important lubricating agents and is used as important raw material.
- **Petroleum refineries act as a 'nodal industry'** for many industries like textile, fertilizer and chemical industry.
- Fuel for heat and light.

- **Formation of Petroleum:**

- It is found in the anticlines & fault traps in the rock formations of tertiary age.
- In regions of folding, anticlines or domes, oil is trapped in the crest of the upfold.
- **Oil bearing layer is a porous limestone or sandstone layer through which oil may flow.**
- The non-porous layers prevent oil from rising or sinking.
- Also found in the fault traps between porous and nonporous rocks.

- **Areas of Distribution**

- 63% of India's petroleum production is from Mumbai high.
- 18% from Gujarat, Ankeleshwar is the most important field of Gujarat.
- 16% from Assam-Digboi, Naharkatiya & Moran-hugrijan are the important oil fields.
- **Assam is the oldest oil producing state of India.**



Natural Gas

- Natural gas is an important clean energy resource found in association with or without petroleum.
- It is used as a source of energy as well as an industrial raw material in the petrochemical industry.
- **Natural gas is considered an environment friendly fuel** because of low carbon dioxide emissions and is, therefore, the fuel for the present century.

• Areas of Distribution

- Krishna-Godavari basin
- Reserves on the west coast at Mumbai high & Gulf of Cambay.
- Andaman & Nicobar Islands.

• Advantages of Natural gas:

- It can be used both as source of energy and also as a industrial raw material in Petro-chemical industry.
- Natural gas is found in association with or without petroleum.
- It takes less time to build a power plant based on natural gas.
- It is easy to transport gas through gas pipes line.
- It is considered an environment friendly fuel because of low carbon dioxide emission.
- It is the fuel for the present century.

• Gas pipe lines

- 1700km long Hazira-Bijapur-Jagdishpur cross country gas pipe line links Mumbai-high and Bassien with fertilizer, power and industrial complex in Western and Northern India.
- The power and fertilizer industry are the main users of natural gas.
- **Compressed Natural Gas (CNG) is being used in vehicles in place of liquid fuel.** This artery has provided an impetus to India's gas production.

Electricity

- Electricity has such a wide range of applications in today's world that, its per-capita consumption is considered as an index of development.
- **Electricity is generated mainly in two ways:**
 - (i) By running water which drives hydro turbines to generate hydroelectricity.
 - (ii) By burning of other fuels such as coal, petroleum and natural gas to drive turbines to produce thermal power.

• Thermal Power

- It is generated by coal, petroleum and natural gas. The thermal power stations use non-renewable fossil fuels for generating electricity.
- **These are exhaustible resources of energy.**
- These cause pollution.
- Thermal power stations can be set at any place.



• Hydro Power

- Hydroelectricity is generated by fast flowing water.
- It is a renewable resource of energy.
- **India has a number of multipurpose project** like the Bhakra Nangal, Damodar Valley Corporation, the Kopili Hydel Power Project etc. producing hydro electricity.
- They do not cause any pollution.
- These should be near the sources of energy.

Non-Conventional Energy Sources

- The growing consumption of energy has resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas.
- Rising prices of oil and gas and their potential shortages have raised uncertainties about the security of energy supply in future, which in turn has serious repercussions on the growth of the national economy.
- Moreover, increasing use of fossil fuels also causes serious environmental problems.
- Hence, there is a pressing need to use renewable energy sources like solar energy, wind, tide, biomass and energy from waste material. **These are called non- conventional energy sources.**
- India is blessed with an abundance of sunlight, water, wind and biomass.
- It has the largest programmes for the development of these renewable energy resources.

• Nuclear or Atomic Energy

- It is obtained by altering the structure of atoms.
- When such an alteration is made, much energy is released in the form of heat and this is used to generate electric power.
- Uranium and Thorium, which are available in Jharkhand and the Aravalli ranges of Rajasthan are used for generating atomic or nuclear power.
- **The Monazite sands of Kerala is also rich in Thorium.**

• Solar Energy

- Solar energy is fast, becoming popular in rural & remote areas.
- India has enormous scope of tapping solar energy as it is a tropical country.
- **Photovoltaic technology converts sunlight directly into electricity.**
- It is expected that solar energy plant will be able to minimise the dependence of rural households on firewood and dung cake, which in turn will contribute to environmental conservation and adequate supply of manure in agriculture.
- The largest solar plant of India is located at Madhapur, near Bhuj, to sterilise milk cans.

• Wind Power

- India now ranks as a 'wind super power' in the world.
- The cost inputs are only at the initial stage and the power generation starts immediately after commissioning.
- Once the generation starts, cost free power is available for about 20 years.
- **The largest wind farms cluster is located in Tamil Nadu from Nagercoil to Madurai.**
- Apart from these Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms.



• Biogas

- Shrubs, farms waste, animal and human waste are used to produce biogas.
- Decomposition of organic matter yields gas, which has higher thermal efficiency in comparison to kerosene dung cake and charcoal.
- **Biogas plant are setup at municipal, cooperative and individual level.**
- The plants using cattle dung are known as 'Gobar gas plant'. These provide twin benefits to the farmers in the form of energy and improved quality of manure.
- It burns without smoke it is cheapest gaseous fuel.

• Tidal Energy

- Oceanic tides can be used to generate electricity.
- Flood gate dams are built across the inlets. During high tide water flows into the inlet and gets trapped when the gate is closed.
- After the tides fall our side the flood gate, the water retained by the food gate flows back to the sea via a pipe that carries it through a power generating turbine.
- In India, the Gulf of Kutchh, provides ideal conditions for utilising tidal energy.
- **Two experimental project have been set up in India** one is located in the Parvati Valley near Manikaram in Himachal Pradesh and the other is in the Puga Valley, Ladakh.

• Geo Thermal Energy

- **The energy produced from using the heat from the interior of the earth is called geo thermal energy.**
- The heat energy increases with increase in depth. In areas of high temperatures at shallow depth, the ground water becomes hot due to the heat from the rocks.
- It rises up to the earth as steam & is used for driving turbines to generate electricity.
- **Two experimental projects to generate geo thermal energy is:**
 - (a) Parvati valley near Manikaran at Himachal Pradesh.
 - (b) Puga valley in Ladakh.

Conservation of Energy Resources

- **Energy is the basic requirement for economic development.**
- Consumption of energy in all forms has been steadily rising all over the country.
- Every sector of economy needs energy. e.g. Agriculture industry, transport, domestic needs etc.
- Energy consumption is steadily rising all over the country.
- We need to adopt a sustainable path of energy development which will include -**Twin planks of sustainable development.**
- We have to take a cautious approach for judicious use of energy. e.g.-
 - (i) Use public transport system instead of individual vehicles
 - (ii) Switch off electricity when not in use.
 - (iii) Use power saving devices.
 - (iv) Using non-conventional sources of energy.
- After all, “Energy Saved is Energy Produced”.