ChronicleIAS

Class Xth NEW NCERT
Chapter-5

1068CH05

MINERALS AND ENERGY RESOURCES

Haban comes to Guwahati with his father from a remote village.

He sees people getting into strange house like objects which move along the road. He also sees a "kitchen" dragging a number of house along with it. He is amazed and asked his father "Why don't our houses move like the one we saw in Guwahati, Ba?"

Ba replies, "These are not houses, they are buses and trains. Unlike our houses these are not made of bricks and stones, metal like iron and alluminium are used in making these. They do not move on their own. They are driven by an engine which needs energy to work."

We use different things in our daily life made from metal. Can you list a number of items used in your house made of metals. Where do these metals come from?

You have studied that the earth's crust is made up of different minerals embedded in the rocks. Various metals are extracted from these minerals after proper refinement.

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.

A bright smile from toothpaste and minerals

Toothpaste cleans your teeth. Abrasive minerals like silica, limestone, aluminium oxide and various phosphate minerals do the cleaning. Fluoride which is used to reduce cavities, comes from a mineral fluorite. Most toothpaste are made white with titanium oxide, which comes from minerals called rutile, ilmenite and anatase. The sparkle in some toothpastes comes from mica. The toothbrush and tube containing the paste are made of plastics from petroleum. Find out where these minerals are found?

Dig a little deeper and find out how many minerals are used to make a light bulb?

All living things need minerals

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.

Dig a little deeper and collect "Nutritional Facts" printed on food labels.

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. Why are they so varied?

You have already learnt about rocks. 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.

Study of Minerals by Geographers and Geologists

Geographers study minerals as part of the earth's crust for a better understanding of landforms. The distribution of mineral resources and associated economic activities are of interest to geographers. A geologist, however, is interested in the formation of minerals, their age and physical and chemical composition.

However, for general and commercial purposes minerals can be classified as under.

Mode of Occurrence of Minerals

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. It is, therefore, important for us to understand the main types of formations in which minerals occur.

Minerals generally occur in these forms:

(i) In igneous and metamorphic rocks minerals may occur in the cracks, crevices, faults or joints. The smaller occurrences are called **veins** and the larger are called **lodes**. In most cases, they are formed when minerals in liquid/molten and gaseous forms are forced upward 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.

(ii) 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. Another group of sedimentary minerals include gypsum, potash salt and sodium salt. These are formed as a result of **evaporation** especially in arid regions.

(iii) Another mode of formation 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.

Classification of Minerals

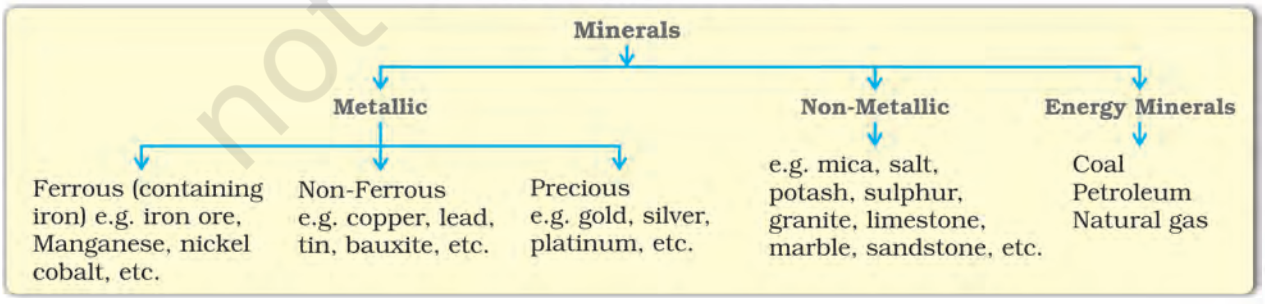


Fig. 5.1

(iv) Certain minerals may occur as **alluvial deposits** in sands of valley floors and the base of hills. These deposits are called 'placer deposits' and generally contain minerals, which are not corroded by water. Gold, silver, tin and platinum are most important among such minerals.

(v) The ocean waters contain vast quantities of minerals, but most of these are too widely diffused to be of economic significance. However, common salt, magnesium and bromine are largely derived from ocean waters. The ocean beds, too, are rich in manganese nodules.

Interesting Fact

Rat-Hole Mining. Do you know that most of the minerals in India are nationalised and their extraction is possible only after obtaining due permission from the government? But in most of the tribal areas of the north-east India, 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. The National Green Tribunal has declared such activities illegal and recommended that these should be stopped forthwith.

Dig a little deeper: What is the difference between an open pit mine, a quarry and an underground mine with shafts?

India is fortunate to have fairly rich and varied mineral resources. However, these are unevenly distributed. Broadly speaking, peninsular rocks contain most of the reserves of coal, metallic minerals, mica and many other non-metallic minerals. Sedimentary rocks on the western and eastern flanks of the peninsula, in Gujarat and Assam have most of the petroleum deposits. Rajasthan with the rock systems of the peninsula, has reserves of many non-ferrous minerals. The vast alluvial plains of north India are almost devoid of economic minerals. These variations exist largely because of the differences in the geological structure, processes and time involved in the formation of minerals.

Let us now study the distribution of a few major minerals in India. Always remember that the concentration of mineral in the ore, the ease of extraction and closeness to the market play an important role in affecting the economic viability of a reserve. Thus, to meet the demand, a choice has to be made between a number of possible options. When this is done a mineral 'deposit' or 'reserve' turns into a **mine**.

Ferrous Minerals

Ferrous minerals account for about three-fourths of the total value of the production of metallic minerals. They provide a strong base for the development of metallurgical industries. India exports substantial quantities of ferrous minerals after meeting her internal demands.

Iron Ore

Iron ore is the basic mineral and the backbone of industrial development. India is endowed with fairly abundant resources of iron ore. India is rich in good quality iron ores. Magnetite is the finest iron ore with a very high content of iron up to 70 per cent. It has excellent magnetic qualities, especially valuable in the electrical industry. Hematite ore is the most important industrial iron ore in terms of the quantity used, but has a slightly lower iron content than magnetite. (50-60 per cent). In 2018–19 almost entire production of iron ore (97%) accrued from Odisha, Chhattisgarh, Karnataka and Jharkhand. The remaining production (3%) was from other states.

Do you know?

Kudre in Kannada means horse. The highest peak in the western ghats of Karnataka resembles the face of a horse. The Bailadila hills look like the hump of an ox, and hence its name.

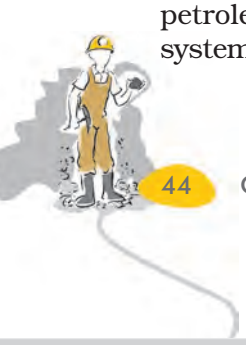


Fig. 5.2: Iron ore mine

The major iron ore belts in India are:

- *Odisha-Jharkhand belt*: In Odisha high grade hematite ore is found in Badampahar mines in the Mayurbhanj and Kendujhar districts. In the adjoining Singbhum district of Jharkhand haematite iron ore is mined in Gua and Noamundi.
- *Durg-Bastar-Chandrapur belt* lies in Chhattisgarh and Maharashtra. Very high grade hematites are found in the famous Bailadila range of hills in the Bastar district of Chhattisgarh. The range of hills comprise of 14 deposits of super high grade hematite iron ore. 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.
- *Ballari-Chitradurga-Chikkamagaluru-Tumakuru belt* in Karnataka has large reserves of iron ore. The Kudremukh mines located in the Western Ghats of Karnataka are a 100 per cent export unit. Kudremukh deposits are known to be one of the largest in the world. The ore is transported as slurry through a pipeline to a port near Mangaluru.
- *Maharashtra-Goa belt* includes the state of Goa and Ratnagiri district of Maharashtra. Though, the ores are not of very high quality, yet they are efficiently exploited. Iron ore is exported through Marmagao port.

Manganese

Manganese is mainly used in the manufacturing of steel and ferro-manganese alloy. Nearly 10 kg of manganese is required to manufacture one tonne of steel. It is also used in manufacturing bleaching powder, insecticides and paints.

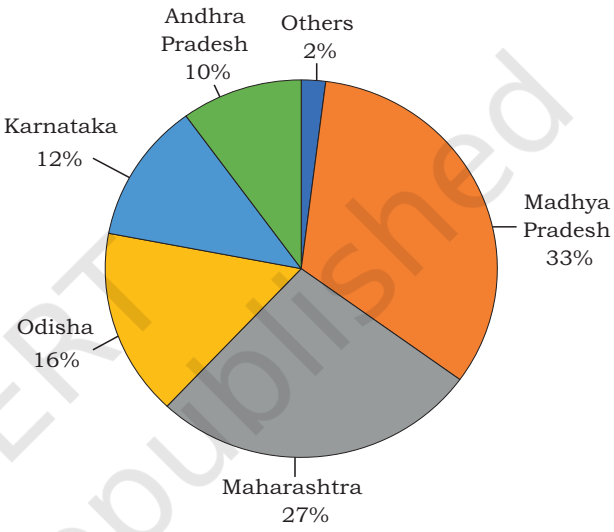


Fig. 5.3: Production of Manganese showing state-wise share in per cent, 2018–19

Dig a little deeper: Superimpose the maps showing distribution of iron ore, manganese, coal and iron and steel industry. Do you see any correlation. Why?

Non-Ferrous Minerals

India's reserves and production of non-ferrous minerals is not very satisfactory. However, these minerals, which include copper, bauxite, lead, zinc and gold play a vital role in a number of metallurgical, engineering and electrical industries. Let us study the distribution of copper and bauxite.

India: *Distribution of Iron Ore, Manganese, Bauxite and Mica*

Copper

India is critically deficient in the reserve and production of copper. Being malleable, ductile and a good conductor, copper is mainly used in electrical cables, electronics and chemical industries. The Balaghat mines in Madhya Pradesh, Khetri mines in Rajasthan and Singhbhum district of Jharkhand are leading producers of copper.

Fig. 5.4: Copper mines at Malanjkhand

Bauxite

Though, several ores contain aluminium, it is from bauxite, a clay-like substance that alumina and later aluminium is obtained. Bauxite deposits are formed by the decomposition of a wide variety of rocks rich in aluminium silicates.

Aluminium is an important metal because it combines the strength of metals such as iron, with extreme lightness and also with good conductivity and great malleability.

India's bauxite deposits are mainly found in the Amarkantak plateau, Maikal hills and the plateau region of Bilaspur-Katni.

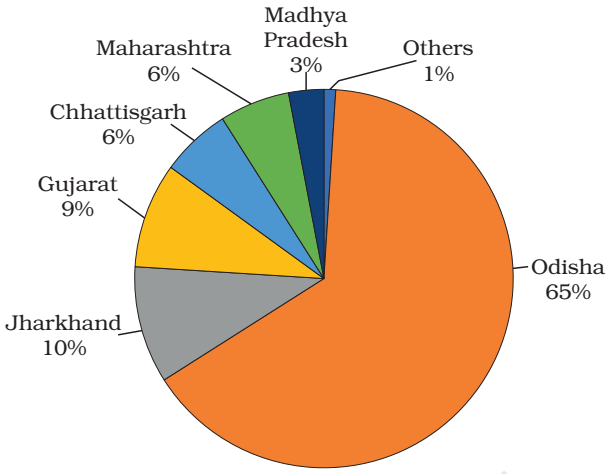


Fig. 5.5: Production of Bauxite showing state-wise share in per cent, 2018–19

Odisha was the largest bauxite producing state in India in 2018-19. Panchpatmali deposits in Koraput district are the most important bauxite deposits in the state.

Fig.5.6: Bauxite Mine

Dig a little deeper: Locate the mines of Bauxite on the physical map of India.

Interesting Fact

After the discovery of aluminium Emperor Napoleon III wore buttons and hooks on his clothes made of aluminium and served food to his more illustrious guests in aluminium utensils and the less honourable ones were served in gold and silver utensils. Thirty years after this incident aluminium bowls were most common with the beggars in Paris.

Non-Metallic Minerals

Mica is a mineral made up of a series of plates or leaves. It splits easily into thin sheets. These sheets can be so thin that a thousand can be layered into a mica sheet of a few centimeters high. Mica can be clear, black, green, red yellow or brown. Due to its excellent di-electric strength, low power loss factor, insulating properties and resistance to high voltage, mica is one of the most indispensable minerals used in electric and electronic industries.

Mica deposits are found in the northern edge of the Chota Nagpur plateau. Koderma Gaya – Hazaribagh belt of Jharkhand is the leading producer.

In Rajasthan, the major mica producing area is around Ajmer. Nellore mica belt of Andhra Pradesh is also an important producer in the country.

Rock Minerals

Limestone is found in association with rocks composed of calcium carbonates or calcium and magnesium carbonates. It is found in sedimentary rocks of most geological formations. Limestone is the basic raw material for the cement industry and essential for smelting iron ore in the blast furnace.

Dig a little deeper: Study the maps to explain why Chota Nagpur is a storehouse of minerals.

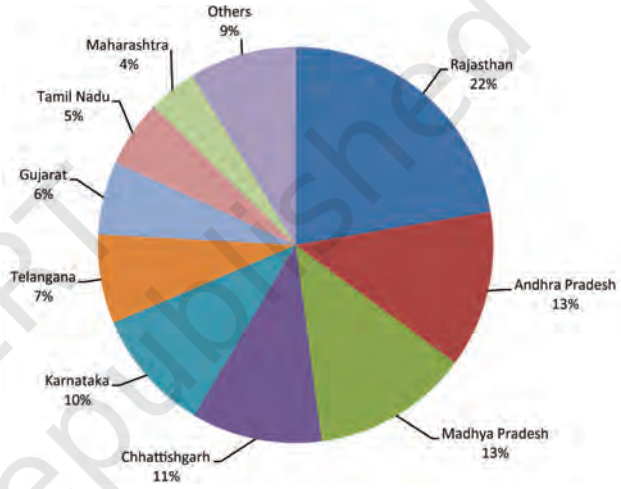


Fig. 5.7: Production of Limestone showing state-wise share in per cent, 2018–19

Hazards of Mining

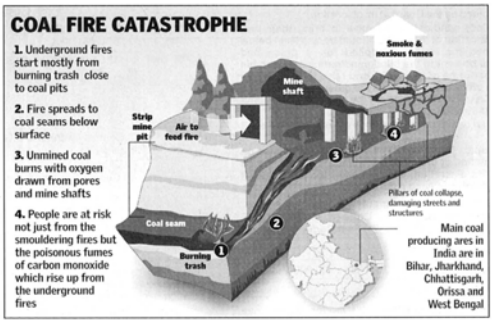
Have you ever wondered about the efforts the miners make in making life comfortable for you? What are the impacts of mining on the health of the miners and the environment?

The dust and noxious fumes inhaled by miners make them vulnerable to pulmonary diseases. The risk of collapsing mine roofs, inundation and fires in coalmines are a constant threat to miners.

The water sources in the region get contaminated due to mining. Dumping of waste and slurry leads to degradation of land, soil, and increase in stream and river pollution.

Fig. 5.8: Air pollution due to generation of dust in mining areas

Jharia to be shifted



Law Kumar Mishra | TNN

Dhanbad: The government has decided to relocate an entire township — Jharia — because of the uncontrollable spread of underground fires that have been burning for years in the coal belt.

"The Centre has already sanctioned Rs 14 crore for the first phase of shifting."

Claiming it to be one of the world's major evacuation drives, Soren said the shifting would be done in three phases in five years and he also assu

1990. According to the Rana panel, the cost of shifting people will be at Rs 20,000 crore. The Rana panel had also said, "It is profitable to shift people from Jharia, since coal worth Rs 60,000 crore is lying unutilised beneath the Jharia

Coal unit fined Rs 300 cr in damages

Dhananjay Mahapatra | TNN

New Delhi: The Supreme Court has asked India's largest coal producing company — South Eastern Coalfields Ltd — to pay within a month Rs 300 crore as compensation for using forest land in Chhattisgarh. This is in addition to Rs 50 crore already paid by the PSU, which is a subsidiary of Coal India Ltd, to continue its operations in the state.

SECL will have to pay Rs 100 crore within a week and the rest within a month, the forest Bench comprising CJI Y K Sabharwal and Justices Arijit Pasayat and S H Kapadia directed on Friday.

The court, in its earlier judgment, had said that all companies were liable to pay Penal Compensatory Afforestation cost and amount of Net Present Value to continue operations in forest land already allotted to them by the states.

Appearing for the PSU, solicitor general G E Vahanvati argued that the company had one of the best records for protection of environment and had won awards at the national and state level. He said the Rs 50 crore already deposited by the company was compensation enough for it to be allowed coal mining operations. Appearing for the ministry of environment and forests, counsel A D N Rao

'Over 50% of coal-belt mines unsafe'

Law Kumar Mishra | TNN

Dhanbad: Three days after one of the worst mining disasters in decades left 54 people dead, the chief of the company which owns these mines, said no less than half the mines in the area did not meet the basic safety standards.

Bharat Coking Coal Ltd (BCCL) chairman Partho S Bhattacharya, however, said on Saturday the company shouldn't be blamed for operating unsafe mines because workers and trade unions had blocked moves to shut these for fear of losing jobs. He said only one out of 41 mines was operated scientifically and of the rest, the many were functioning against the advice of the Directorate General of Mines Safety. He described safety standards in 24 mines as poor.

Bhattacharya said workers were aware that they would have to seek voluntary retirement if unsafe mines were shut.

Bharat Coking Coal management on Saturday also handed over employment letters to the immediate people nominated by families of victims. Ironically, these people, most likely, would go to work in mines deemed unsafe by the company.

BCCL's audit of the safety status of mines, graded second and third degrees,

WAIT AND WATCH: A crowd watches the ongoing rescue operation outside the Bharat Coking Coal Ltd mine at Bhatdih in Jharkhand on Thursday

'Safety standards were not in place'

Law Kumar Mishra | TNN

Dhanbad: Union coal minister Shibu Soren on Thursday announced an ex gratia of Rs 3 lakh to the families of the mine tragedy victims. Soren said: "Dependents of the victims will be provided employment by the Bharat Coking Coal from today. A probe by the director general of mines safety and the labour commissioner will also be initiated."

Soren also held discussions with Bharat Coking Coal officials and promised medical help to the four survivors.

tained, even though the director general of mine safety carries out surveys of the safety norms," an expert said.

Some agitating miners alleged that "there is no emergency measures inside the mine. We go deep — between 400 feet and 1,500 ft — into the mines with only an oxygen mask." The tragedy points to the lack of security measures by Bharat Coking Coal despite previous instances of disasters due to methane leak.

At least 48 people were killed in explosions in Jeetpur mine, 43 in Sudamdeeh and 30 in

Stricter safety regulations and implementation of environmental laws are essential to prevent mining from becoming a "killer industry".

Conservation of Minerals

We all appreciate the strong dependence of industry and agriculture upon mineral deposits and the substances manufactured from them. The total volume of workable mineral deposits is an insignificant fraction i.e. one per cent of the earth's crust. We are rapidly consuming mineral resources that required millions of years to be created and concentrated. The geological processes of mineral formation are so slow that the rates of replenishment are infinitely small in comparison to the present rates of consumption. Mineral resources are, therefore, finite and non-renewable. Rich mineral deposits are our country's extremely valuable but short-lived possessions. Continued extraction of ores leads to increasing costs as mineral extraction comes from greater depths along with decrease in quality.

A concerted effort has to be made in order to use our mineral resources in a planned and sustainable manner. Improved technologies need to be constantly evolved to allow use of low grade ores at low costs. Recycling of metals, using scrap metals and other substitutes are steps in conserving our mineral resources for the future.

Dig a little deeper: Make a list of items where substitutes are being used instead of minerals. Where are these substitutes obtained from?

Energy Resources

Energy is required for all activities. It is needed to cook, to provide light and heat, to propel vehicles and to drive machinery in industries.

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. Conventional sources include: firewood, cattle dung cake, coal, petroleum, natural gas and electricity (both hydel and thermal). Non-conventional sources include solar, wind, tidal, geothermal, biogas and atomic energy. Firewood and cattle dung cake are most common in rural India. 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. Moreover, using dung cake too is being discouraged because it consumes most valuable manure which could be used in agriculture.

Conventional Sources of Energy

Coal: In India, coal is the most abundantly available fossil fuel. It provides a substantial part of the nation's energy needs. It is used for power generation, to supply energy to industry as well as for domestic needs. India is highly dependent on coal for meeting its commercial energy requirements.

As you are already aware that coal is formed due the compression of plant material over millions of years. Coal, therefore, is found in a variety of forms depending on the degrees of compression and the depth and time of burial. Decaying plants in swamps produce peat. Which has a low carbon and high moisture contents and low heating capacity. **Lignite** is a low grade brown coal, which is soft with high moisture content. The principal lignite reserves are in Neyveli in Tamil Nadu and are used for generation of electricity. Coal that has been buried deep and subjected to increased temperatures is **bituminous** coal. It is the most popular coal in commercial use. Metallurgical coal is high grade bituminous coal which has a special value for smelting iron in blast furnaces. **Anthracite** is the highest quality hard coal.

In India coal occurs in rock series of two main geological ages, namely Gondwana, a little over 200 million years in age and in tertiary deposits which are only about 55 million years old. The major resources of Gondwana coal, which are metallurgical coal, are located in Damodar valley (West Bengal-

Fig. 5.9 (a): A view from inside of a coal mine

Fig. 5.9 (b): A view from outside of a coal mine

India: *Distribution of Coal, Oil and Natural Gas*

Activity

Collect information about cross country natural gas pipelines laid by GAIL (India) under "One Nation One Grid".

Jharkhand). Jharia, Raniganj, Bokaro are important coalfields. The Godavari, Mahanadi, Son and Wardha valleys also contain coal deposits.

Tertiary coals occur in the north eastern states of Meghalaya, Assam, Arunachal Pradesh and Nagaland.

Remember coal is a bulky material, which loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power stations are located on or near the coalfields.

Petroleum

Petroleum or mineral oil is the next major energy source in India after coal. It provides fuel for heat and lighting, lubricants for machinery and raw materials for a number of manufacturing industries. Petroleum refineries act as a "nodal industry" for synthetic textile, fertiliser and numerous chemical industries.

Most of the petroleum occurrences in India are associated with anticlines and fault traps in the rock formations of the tertiary age. In regions of folding, anticlines or domes, it occurs where oil is trapped in the crest of the upfold. The oil bearing layer is a porous limestone or sandstone through which oil may flow. The oil is prevented from rising or sinking by intervening non-porous layers.

Petroleum is also found in fault traps between porous and non-porous rocks. Gas, being lighter usually occurs above the oil.

Mumbai High, Gujarat and Assam are major petroleum production areas in India. From the map locate the 3 major off shore fields of western India. Ankeleshwar is the most important field of Gujarat. Assam is the oldest oil producing state of India. Digboi, Naharkatiya and Moran-Hugrijan are the important oil fields in the state.

Natural Gas

Natural Gas is found with petroleum deposits and is released when crude oil is brought to the surface. It can be used as a domestic and industrial fuel. It is used as fuel in power sector to generate electricity, for heating purpose in industries, as raw material in chemical, petrochemical and fertilizer industries, as transport fuel and as cooking fuel. With the expansion of gas infrastructure and local city gas distribution (COD) networks, natural gas is also emerging as a preferred transport fuel (CNG) and cooking fuel (PNG) at homes. India's major gas reserves are found in the Mumbai High and allied fields along the west coast which are supplemented by finds in the Cambay basin. Along the East Coast, new reserves of natural gas have been discovered in the Krishna-Godavari basin.

The first 1,700 km long Hazira-Vijaipur-Jagdishpur (HVJ) cross country gas pipeline, constructed by GAIL (India), linked Mumbai High and Bassein gas fields with various fertilizer, power and industrial complexes in western and northen India. This artery provided impetus to Indian gas market development. Overall, India's gas infrastructure has expanded over ten times from 1,700 km to 18,500 km of cross-country pipelines and is expected to soon reach over 34, 000 km as Gas Grid by linking all gas sources and consuming markets across the country including North Eastern states.

Electricity

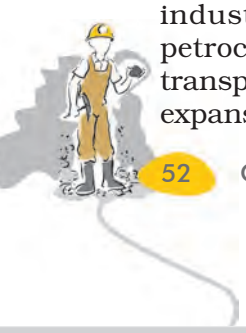
Electricity has such a wide range of applications in today's world that, its percapita consumption is considered as an index of development. Electricity is generated mainly in two ways: by running water which drives hydro turbines to generate *hydro electricity;* and by burning other fuels such as coal, petroleum and natural gas to drive turbines to produce *thermal power.* Once generated the electricity is exactly the same.

Activity

Name some river valley projects and write the names of the dams built on these rivers.

Hydro electricity is generated by fast flowing water, which is a renewable resource. India has a number of multi-purpose projects like the Bhakra Nangal, Damodar Valley corporation, the Kopili Hydel Project etc. producing hydroelectric power.

Thermal electricity is generated by using coal, petroleum and natural gas. The thermal power stations use non-renewable fossil fuels for generating electricity.



India: *Distribution of Nuclear and Thermal Power Plants*

Collect information about thermal/hydel power plants located in your state. Show them on the map of India.

Non-Conventional Sources of Energy

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.

Locate the 6 nuclear power stations and find out the state in which they are located.

Solar Energy

India is a tropical country. It has enormous possibilities of tapping solar energy. Photovoltaic technology converts sunlight directly into electricity. Solar energy is fast becoming popular in rural and remote areas. Some big solar power plants are being established in different parts of India which will minimise the dependence of rural households on firewood and dung cakes, which in turn will contribute to environmental conservation and adequate supply of manure in agriculture.

Fig. 5.10: Solar operated electronic milk testing equipment

Activity

Collect information about newly established solar power plants in India.

Wind power

India has great potential of wind power. The largest wind farm cluster is located in Tamil Nadu from Nagarcoil to Madurai. Apart from these, Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms. Nagarcoil and Jaisalmer are well known for effective use of wind energy in the country.

Fig. 5.11: Wind mills – Nagarcoil

Biogas

Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas. Decomposition of organic matter yields gas, which has higher thermal efficiency in comparison to kerosene, dung cake and charcoal. Biogas plants are set up at municipal, cooperative and individual levels. The plants using cattle dung are known as *'Gobar gas plants'* in rural India. These provide twin benefits to the farmer in the form of energy and improved quality of

manure. Biogas is by far the most efficient use of cattle dung. It improves the quality of manure and also prevents the loss of trees and manure due to burning of fuel wood and cow dung cakes.

Fig. 5.12: Biogas Plant

Tidal Energy

Oceanic tides can be used to generate electricity. Floodgate dams are built across inlets. During high tide water flows into the inlet and gets trapped when the gate is closed. After the tide falls outside the flood gate, the water retained by the floodgate flows back to the sea via a pipe that carries it through a power-generating turbine.

In India the Gulf of Khambhat, the Gulf of Kuchchh in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.

Geo Thermal Energy

Geo thermal energy refers to the heat and electricity produced by using the heat from the interior of the Earth. Geothermal energy exists because, the Earth grows progressively hotter with increasing depth. Where the geothermal gradient is high, high temperatures are found at shallow depths. Groundwater in such areas absorbs heat from the rocks and becomes hot. It is so hot that when it rises to the earth's surface, it turns into steam. This steam is used to drive turbines and generate electricity.

There are several hundred hot springs in India, which could be used to generate electricity. Two experimental projects have been set up in India to harness geothermal energy. One is located in the Parvati valley near Manikaran in Himachal Pradesh and the other is located in the Puga Valley, Ladakh.

Conservation of Energy Resources

Energy is a basic requirement for economic development. Every sector of the national economy – agriculture, industry, transport, commercial and domestic – needs inputs of energy. The economic development plans implemented since Independence necessarily required increasing amounts of energy to remain operational. As a result, consumption of energy in all forms has been steadily rising all over the country.

In this background, there is an urgent need to develop a sustainable path of energy development. Promotion of energy conservation and increased use of renewable energy sources are the twin planks of sustainable energy.

India is presently one of the least energy efficient countries in the world. We have to adopt a cautious approach for the judicious use of our limited energy resources. For example, as concerned citizens we can do our bit by using public transport systems instead of individual vehicles; switching off electricity when not in use, using power-saving devices and using non-conventional sources of energy. After all, "energy saved is energy produced".

EXERCISES EXERCISES EXERCISES EXERCISES EXERCISES

1. Multiple choice questions.

   (i) Which one of the following minerals is formed by decomposition of rocks, leaving a residual mass of weathered material?

   (a) coal (b) bauxite (c) gold (d) zinc

   (ii) Koderma, in Jharkhand is the leading producer of which one of the following minerals?

   (a) bauxite (b) mica (c) iron ore (d) copper

(iii) Minerals are deposited and accumulated in the stratas of which of the following rocks?

(a) sedimentary rocks (c) igneous rocks

(b) metamorphic rocks (d) none of the above

(iv) Which one of the following minerals is contained in the Monazite sand?

(a) oil (b) uranium (c) thorium (d) coal

2. Answer the following questions in about 30 words.

(i) Distinguish between the following in not more than 30 words.

(a) ferrous and non-ferrous minerals

(b) conventional and non-conventional sources of energy

(ii) What is a mineral?

(iii) How are minerals formed in igneous and metamorphic rocks?

(iv) Why do we need to conserve mineral resources ?

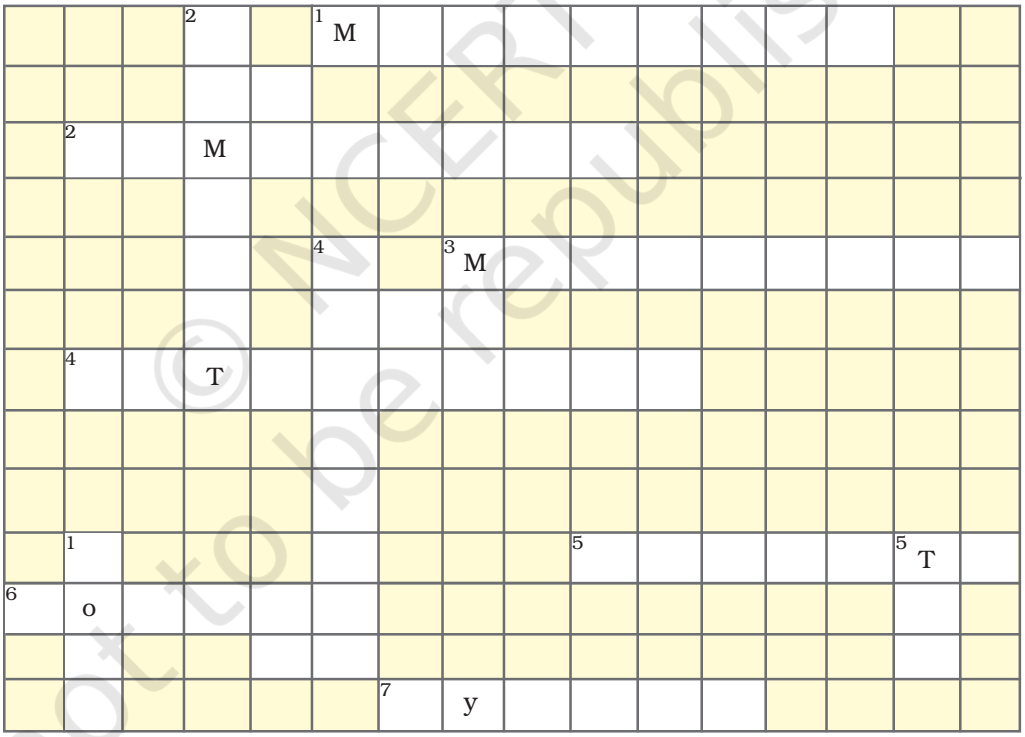
3. Answer the following questions in about 120 words.

(i) Describe the distribution of coal in India.

(ii) Why do you think that solar energy has a bright future in India?

Activity

Fill the name of the correct mineral in the crossword below:



Across

1. A ferrous mineral (9)
2. Raw material for cement industry (9)
3. Finest iron ore with magnetic properties (9)
4. Highest quality hard coal (10)
5. Aluminium is obtained from this ore (7)
6. Khetri mines are famous for this mineral (6)
7. Formed due to evaporation (6)

Down

1. Found in placer deposit (4)
2. Iron ore mined in Bailadila (8)
3. Indispensable for electrical industry (4)
4. Geological Age of coal found in north east India (8)
5. Formed in veins and lodes (3)

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Chapter-5

Unit III
Chapter 5

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MINERAL AND ENERGY RESOURCES

India is endowed with a rich variety of mineral resources due to its varied geological structure. Bulk of the valuable minerals are products of pre-palaezoic age (Refer: Chapter 2 of Class XI, Textbook: *"Fundamentals of Physical Geography"* and are mainly associated with metamorphic and igneous rocks of the peninsular India. The vast alluvial plain tract of north India is devoid of minerals of economic use. The mineral resources provide the country with the necessary base for industrial development. In this chapter, we shall discuss the availability of various types of mineral and energy resources in the country.

A mineral is a natural substance of organic or inorganic origin with definite chemical and physical properties.

Types of Mineral Resources

On the basis of chemical and physical properties, minerals may be grouped under two main categories of metallics and non-metallics which may further be classified as follows :

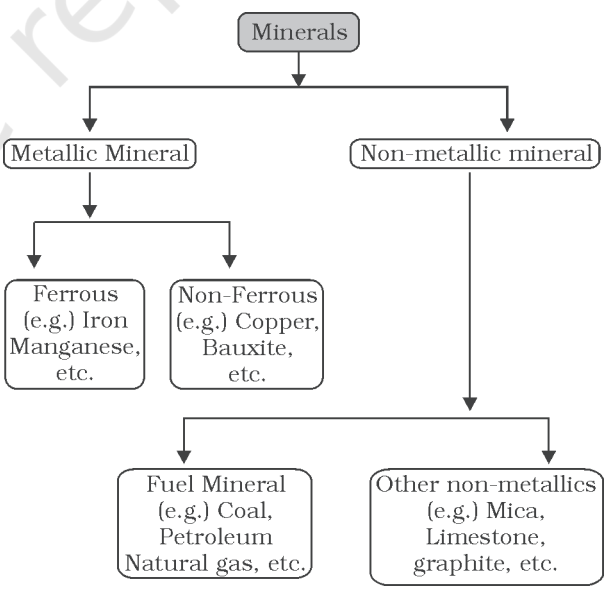

Fig. 5.1 : Classification of Minerals

As, it is clear from the Fig. 5.1 metallic minerals are the sources of metals. Iron ore, copper, gold produce metal and are included in this category. Metallic minerals are further divided into ferrous and non-ferrous metallic minerals. Ferrous, as you know, refers to iron. All those minerals which have iron content are ferrous such as iron ore itself and those which do not have iron content are non-ferrous such as copper, bauxite, etc.

Non-metallic minerals are either organic in origin such as fossil fuels also known as mineral fuels which are derived from the buried animal and plant life such as coal and petroleum. Other type of non-metallic minerals are inorganic in origin such as mica, limestone and graphite, etc.

Minerals have certain characteristics. These are unevenly distributed over space. There is inverse relationship in quality and quantity of minerals i.e. good quality minerals are less in quantity as compared to low quality minerals. The third main characteristic is that all minerals are exhaustible over time. These take long to develop geologically and they cannot be replenished immediately at the time of need. Thus, they have to be conserved and not misused as they do not have the second crop.

Distribution of Minerals in India

Most of the metallic minerals in India occur in the peninsular plateau region in the old crystalline rocks. Over 97 per cent of coal reserves occur in the valleys of Damodar, Sone, Mahanadi and Godavari. Petroleum reserves are located in the sedimentary basins of Assam, Gujarat and Mumbai High i.e. off-shore region in the Arabian Sea. New reserves have been located in the Krishna-Godavari and Kaveri basins. Most of the major mineral resources occur to the east of a line linking Mangaluru and Kanpur.

Minerals are generally concentrated in three broad belts in India. There may be some sporadic occurrences here and there in isolated pockets. These belts are :

The North-Eastern Plateau Region

This belt covers Chhotanagpur (Jharkhand), Odisha Plateau, West Bengal and parts of Chhattisgarh. Have you ever thought about the reason of major iron and steel industry being located in this region? It has variety of minerals viz. iron ore coal, manganese, bauxite, mica.

Find out the specific region where these minerals are being extracted.

The South-Western Plateau Region

This belt extends over Karnataka, Goa and contiguous Tamil Nadu uplands and Kerala. This belt is rich in ferrous metals and bauxite. It also contains high grade iron ore, manganese and limestone. This belt lacks in coal deposits except Neyveli lignite.

This belt does not have as diversified mineral deposits as the north-eastern belt. Kerala has deposits of monazite and thorium, bauxite clay. Goa has iron ore deposits.

The North-Western Region

This belt extends along Aravali in Rajasthan and part of Gujarat and minerals are associated with Dharwar system of rocks. Copper, zinc have been major minerals. Rajasthan is rich in building stones i.e. sandstone, granite, marble. Gypsum and Fuller's earth deposits are also extensive. Dolomite and limestone provide raw materials for cement industry. Gujarat is known for its petroleum deposits. You may be knowing that Gujarat and Rajasthan both have rich sources of salt.

Why and where Dandi March was organised by Mahatma Gandhi?

The Himalayan belt is another mineral belt where copper, lead, zinc, cobalt and tungsten are known to occur. They occur on both the eastern and western parts. Assam valley has

mineral oil deposits. Besides oil resources are also found in off-shore-areas near Mumbai Coast (Mumbai High).

In the following pages you will find the spatial pattern of some of the important minerals.

Ferrous Mineral

Ferrous minerals such as iron ore, manganese, chromite, etc., provide a strong base for the development of metallurgical industries. Our country is well-placed in respect of ferrous minerals both in reserves and production.

Iron Ore

India is endowed with fairly abundant resources of iron ore. It has the largest reserve of iron ore in Asia. The two main types of ore found in our country are *haematite* and *magnetite*. It has great demand in international market due to its superior quality. The iron ore mines occur in close proximity to the coal fields in the north-eastern plateau region of the country which adds to their advantage.

About 95 per cent of total reserves of iron ore is located in the States of Odisha, Jharkhand, Chhattisgarh, Karnataka, Goa, Telangana, Andhra Pradesh and Tamil Nadu. In Odisha, iron ore occurs in a series of hill ranges in Sundergarh, Mayurbhanj and Jhar. The important mines are Gurumahisani, Sulaipet, Badampahar (Mayurbhaj), Kiruburu (Kendujhar) and Bonai (Sundergarh). Similar hill ranges, Jharkhand has some of the oldest iron ore mines and most of the iron and steel plants are located around them. Most of the important mines such as Noamundi and Gua are located in Poorbi and Pashchimi Singhbhum districts. This belt further extends to Durg, Dantewara and Bailadila. Dalli, and Rajhara in Durg are the important mines of iron ore in the country. In Karnataka, iron ore deposits occur in Sandur-Hospet area of Ballari district, Baba Budan hills and Kudremukh in Chikkamagaluru district and parts of Shivamogga, Chitradurg and Tumakuru districts. The districts of Chandrapur, Bhandara and Ratnagiri in Maharashtra, Karimnagar and Warangal district of Telangana, Kurnool, Cuddapah and Anantapur districts of Andhra Pradesh, Salem and Nilgiris districts of Tamil Nadu are other iron mining regions. Goa has also emerged as an important producer of iron ore.

Iron ore mining gets a boost

The iron ore mining industry in India is attracting several new players, both large and small

Any industrialised nation requires vast quantities of iron ore, which is the basic raw material from which iron and steel are made. India is no exception, and its development over the past few decades has necessitated huge reserves of iron and steel. Iron ore is produced in approximately 46 countries, and world resources are estimated to exceed 800 billion tons of crude ore containing more than 230 billion tons of iron. While Brazil and China are world leaders in iron ore production and consumption, India ranks sixth in terms of iron ore deposits. Interestingly however, India's per capita mineral consumption is one of the lowest in the world.

The Indian ferrous industry can be divided into ore miners and producers. Ore miners are engaged in mining activities to extract the ore, largely for the use of producers. Key players include National Mineral Development Corporation (NMDC), Kudremukh Iron Ore Co (KIOCL), Essel Mining & Industries Ltd, and Sesa Goa (Sesa). Other players like the Belgaum based PVG group which has tied up with the Kolhapur-based Ghodawat Group to form Star PVG exports are also making a mark. Iron ore mines are mostly located in Jharkhand, Orissa, West Bengal, Chattisgarh and Karnataka. Recently however, some Indian steel manufacturing companies have invested in steel and coal mines abroad, such as in Australia.

Producers are classified into main or integrated producers, and oth... grated producers account ... of ... crude steel production in ... jor integrated steel produc... ity of India Ltd (SAIL), Ra... Limited (RINL), and TIS... the best-known private sector companies in the country. Companies like SAIL and TISCO have their own captive mines. The other or secondary producers include re-rollers and stand alone producers in the organised and unorganised segments, and account for the remaining 33% of India's steel production. Producers are also classified on the basis of the production process and the type of products (long or flat) manufactured by the producers.

Stand alone producers produce sponge iron and pig iron to be used by the main producers. India is the largest producer of coal based sponge iron in the world, and accounts for 15% of the global output. Jindal Steel & Power Ltd. is the largest producer of coal based sponge iron in India - it is also the second largest in the world - with a capacity of 650,000 TPA. KIOCL, Sesa Goa and Usha Ispat are the major producers of pig iron. Integrated steel plants like SAIL and RINL also produce a significant amount of pig iron.

While iron ore is a major component of the steel manufacturing process, scrap is often used to supplement it, though it is in relative- ... rect indicators of iron ore consumption than crude steel. However, imports of iron ore are not a direct indicator of a change in iron ore consumption in any country that produces iron ore.

The Government of India has taken several steps to promote the growth of the mineral sector under the overall framework of the National Mineral Policy, 1993. The amended Mines and Minerals (Development and Regulation) Act (MMDR Act) is aimed at attractin... private investment and foreign direct investment (FDI) into the sector. It is estimated tha... the production of iron ore during the termina... year of the Tench Plan (2006-07) will touch 11... mt, with around 40 mt exported annually during the Plan period. The Government also regulates the amount of iron ore to be extracted to counter pollution. Modern excavation heavy blasting techniques have been developed which help minimise damage to the environment.

Export of high-grade iron ore has been so far channeled through the Minerals and Metals Trading Corporation Ltd. (MMTC), and quantitative restrictions were imposed by the Government to ensure that indigenous demand was met before any surplus could be exported. However a shift in this policy is expected.

With the number of end user industries in India growing at a significant rate, the production of steel based products is ... prospect, drawing a larg... of ...

Can you find out its reason?

Manganese

Manganese is an important raw material for smelting of iron ore and also used for manufacturing ferro alloys. Manganese deposits are found in almost all geological formations, however, it is mainly associated with Dharwar system.

Madhya Pradesh and Odisha are the leading producers of Manganese. Major mines in Odisha are located in the central part of the iron ore belt of India, particularly in Bonai, Kendujhar, Sundergarh, Gangpur, Koraput, Kalahandi and Bolangir.

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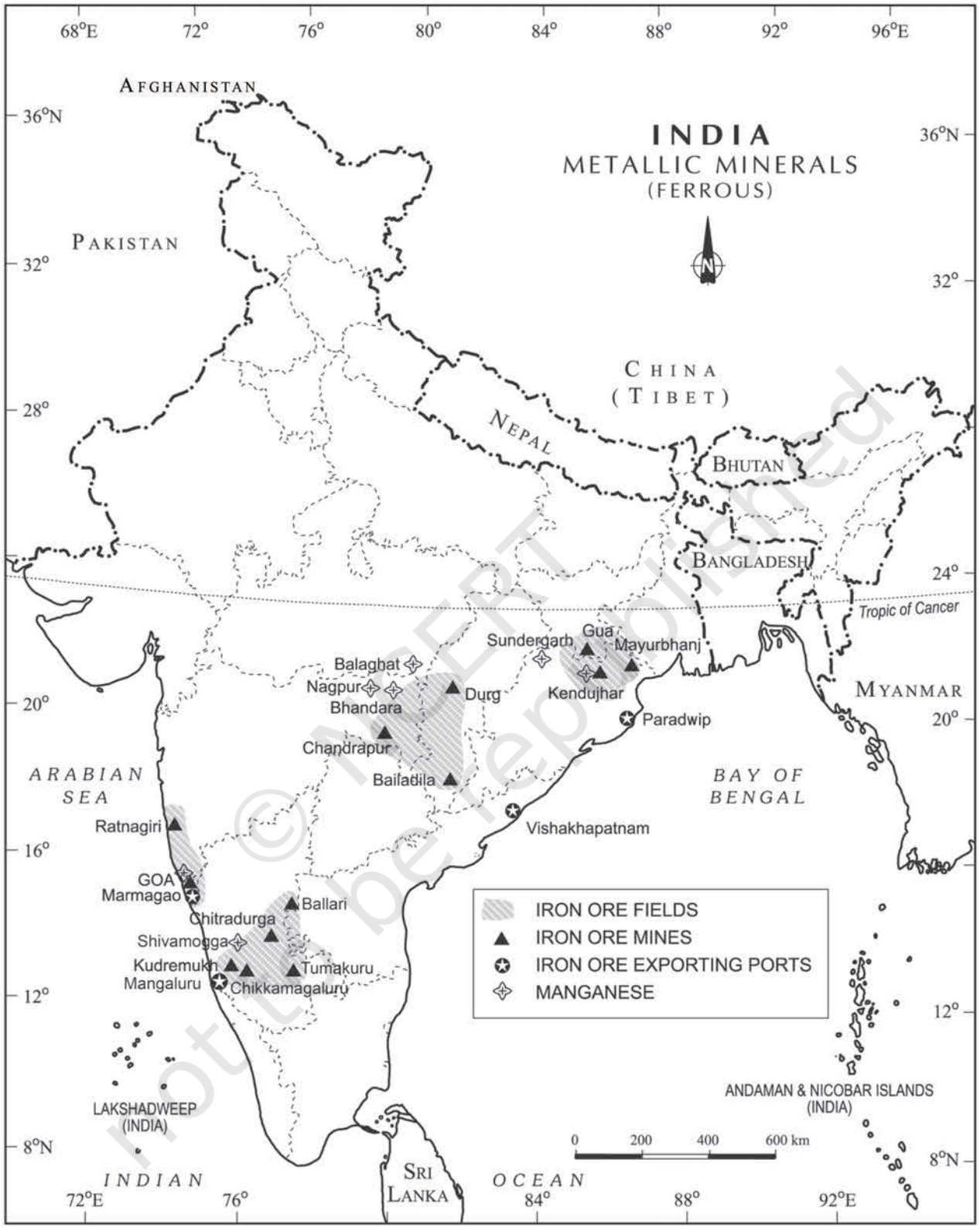

Fig. 5.2 : India – Metallic Minerals (Ferrous)

The manganese belt of Madhya Pradesh extends in a belt in Balaghat-Chhindwara-Nimar-Mandla and Jhabua districts. Karnataka is another major producer and here the mines are located in Dharwar, Ballari, Belagavi, North Canara, Chikkmagaluru, Shivamogga, Chitradurg and Tumakuru. Maharashtra is also an important producer of manganese, which is mined in Nagpur, Bhandara and Ratnagiri districts. The disadvantage to these mines is that they are located far from steel plants.

Telangana, Goa, and Jharkhand are other minor producers of manganese.

Non-Ferrous Minerals

India is poorly endowed with non-ferrous metallic minerals except bauxite.

Bauxite

Bauxite is the ore, which is used in manufacturing of aluminium. Bauxite is found mainly in tertiary deposits and is associated with laterite rocks occurring extensively either on the plateau or hill ranges of peninsular India and also in the coastal tracts of the country.

Odisha happens to be the largest producer of Bauxite. Kalahandi and Sambalpur are the leading producers. The other two areas which have been increasing their production are Bolangir and Koraput. The patlands of Lohardaga in Jharkhand have rich deposits. Gujarat, Chhattisgarh, Madhya Pradesh and Maharashtra are other major producers. Bhavanagar, and Jamnagar in Gujarat have the major deposits. Chhattisgarh has bauxite deposits in Amarkantak plateau while Katni-Jabalpur area and Balaghat in M.P. have important deposits of bauxite. Kolaba, Thane, Ratnagiri, Satara, Pune and Kolhapur in Maharashtra are important producers. Tamil Nadu, Karnataka and Goa are minor producers of bauxite.

Copper

Copper is an indispensable metal in the electrical industry for making wires, electric motors, transformers and generators. It is alloyable, malleable and ductile. It is also mixed with gold to provide strength to jewellery.

The Copper deposits mainly occur in Singhbhum district in Jharkhand, Balaghat district in Madhya Pradesh and Jhunjhunu and Alwar districts in Rajasthan.

Minor producers of Copper are Agnigundala in Guntur District (Andhra Pradesh), Chitradurg and Hasan districts (Karnataka) and South Arcot district (Tamil Nadu).

Non-metallic Minerals

Among the non-metallic minerals produced in India, mica is the important one. The other minerals extracted for local consumption are limestone, dolomite and phosphate.

Mica

Mica is mainly used in the electrical and electronic industries. It can be split into very thin sheets which are tough and flexible. Mica in India is produced in Jharkhand, Andhra Pradesh, Telanganga and Rajasthan followed by Tamil Nadu, West Bengal and Madhya Pradesh. In Jharkhand, high quality mica is obtained in a belt extending over a distance of about 150 km, in length and about 22 km, in width in lower Hazaribagh plateau. In Andhra Pradesh, Nellore district produces the best quality mica. In Rajasthan, mica belt extends for about 320 kms from Jaipur to Bhilwara and around Udaipur. Mica deposits also occur in Mysuru and Hasan districts of Karanataka, Coimbatore, Tiruchirapalli, Madurai and Kanniyakumari in Tamil Nadu, Alleppey in Kerala, Ratnagiri in Maharashtra, Purulia and Bankura in West Bengal.

Energy Resources

Mineral fuels are essential for generation of power, required by agriculture, industry, transport and other sectors of the economy. Mineral fuels like coal, petroleum and natural gas (known as fossil fuels), nuclear energy minerals, are the conventional sources of energy. These conventional sources are exhaustible resources.

Fig. 5.3 : India – Minerals (Non-Ferrous)

Coal

Coal is a one of the important minerals which is mainly used in the generation of thermal power and smelting of iron ore. Coal occurs in rock sequences mainly of two geological ages, namely Gondwana and tertiary deposits.

About 80 per cent of the coal deposits in India is of bituminous type and is of non-coking grade. The most important Gondwana coal fields of India are located in Damodar Valley. They lie in Jharkhand-Bengal coal belt and the important coal fields in this region are Raniganj, Jharia, Bokaro, Giridih, Karanpura.

Jharia is the largest coal field followed by Raniganj. The other river valleys associated with coal are Godavari, Mahanadi and Sone. The most important coal mining centres are Singrauli in Madhya Pradesh (part of Singrauli coal field lies in Uttar Pradesh), Korba in Chhattisgarh, Talcher and Rampur in Odisha, Chanda–Wardha, Kamptee and Bander in Maharashtra and Singareni in Telangana and Pandur in Andhra Pradesh.

Tertiary coals occur in Assam, Arunachal Pradesh, Meghalaya and Nagaland. It is extracted from Darangiri, Cherrapunji, Mewlong and Langrin (Meghalaya); Makum, Jaipur and Nazira in upper Assam, Namchik – Namphuk (Arunachal Pradesh) and Kalakot (Jammu and Kashmir).

Besides, the brown coal or lignite occur in the coastal areas of Tamil Nadu, Puducherry, Gujarat and Jammu and Kashmir.

Petroleum

Crude petroleum consists of hydrocarbons of liquid and gaseous states varying in chemical composition, colour and specific gravity. It is an essential source of energy for all internal combustion engines in automobiles, railways and aircraft. Its numerous by-products are processed in petrochemical industries, such as fertiliser, synthetic rubber, synthetic fibre, medicines, vaseline, lubricants, wax, soap and cosmetics.

Do You Know ?

Petroleum is referred to as liquid gold because of its scarcity and diversified uses.

Crude petroleum occurs in sedimentary rocks of the tertiary period. Oil exploration and production was systematically taken up after the Oil and Natural Gas Commission was set up in 1956. Till then, Digboi in Assam was the only oil producing region but the scenario changed after 1956. In recent years, new oil deposits have been found at the extreme western and eastern parts of the country. In Assam, Digboi, Naharkatiya and Moran are important oil producing areas. The major oilfields of Gujarat are Ankaleshwar, Kalol, Mehsana, Nawagam, Kosamba and Lunej. Mumbai High which lies 160 km off Mumbai was discovered in 1973 and production commenced in 1976. Oil and natural gas have been found in exploratory wells in Krishna-Godavari and Kaveri basin on the east coast.

Oil extracted from the wells is crude oil and contains many impurities. It cannot be used directly. It needs to be refined. There are two types of refineries in India: (a) field-based and (b) market-based. Digboi is an example of field-based and Barauni is an example of market-based refinery.

Natural Gas

Natural Gas is found with petroleum deposits and is released when crude oil is brought to

Fig. 5.4 : India – Conventional Energy Resources

Activity: Collect information about cross country natural gas pipelines laid by GAIL (India) under 'One Nation One Grid'.

the surface. It can be used as a domestic and industrial fuel. It is used as fuel in power sector to generate electricity, for heating purpose in industries, as raw material in chemical, petrochemical and fertiliser industries. With the expansion of gas infrastructure and local city gas distribution (COD) networks, natural gas is also emerging as a preferred transport fuel (CNG) and cooking fuel (PNG) at homes. India's major gas reserves are found in the Mumbai High and allied fields along the west coast which are supplemented by finds in the Cambay basin. Along the East Coast, new reserves of natural gas have been discovered in the Krishna-Godavari basin.

Non-Conventional Energy Sources

Fossil fuel sources, such as coal, petroleum, natural gas and nuclear energy use exhaustible raw materials. Sustainable energy resources are only the renewable energy sources like solar, wind, hydro-geothermal and biomass. These energy sources are more equitably distributed and environment-friendly. The non-conventional energy sources will provide more sustained, eco-friendly cheaper energy after the initial cost is taken care of.

Nuclear Energy Resources

Nuclear energy has emerged as a viable source in recent times. Important minerals used for the generation of nuclear energy are uranium and thorium. Uranium deposits occur in the Dharwar rocks. Geographically, uranium ores are known to occur in several locations along the Singbhum Copper belt. It is also found in Udaipur, Alwar and Jhunjhunu districts of Rajasthan, Durg district of Chhattisgarh, Bhandara district of Maharashtra and Kullu district of Himachal Pradesh. Thorium is mainly obtained from monazite and ilmenite in the beach sands along the coast of Kerala and Tamil Nadu. World's richest monazite deposits occur in Palakkad and Kollam districts of Kerala, near Vishakhapatnam in Andhra Pradesh and Mahanadi river delta in Odisha.

Atomic Energy Commission was established in 1948, progress could be made only after the establishment of the Atomic Energy Institute at Trombay in 1954 which was renamed as the Bhabha Atomic Research Centre in 1967. The important nuclear power projects are Tarapur (Maharashtra), Rawatbhata near Kota (Rajasthan), Kalpakkam (Tamil Nadu), Narora (Uttar Pradesh), Kaiga (Karnataka) and Kakarapara (Gujarat).

Solar Energy

Sun rays tapped in photovoltaic cells can be converted into energy, known as solar energy. The two effective processes considered to be very effective to tap solar energy are photovoltaics and solar thermal technology. Solar thermal technology has some relative advantages over all other non-renewable energy sources. It is cost competitive, environment friendly and easy to construct. Solar energy is 7 per cent more effective than coal or oil based plants and 10 per cent more effective than nuclear plants. It is generally used more in appliances like heaters, crop dryers, cookers, etc. The western part of India has greater potential for the development of solar energy in Gujarat and Rajasthan.

Wind Energy

Wind energy is absolutely pollution free, inexhaustible source of energy. The mechanism of energy conversion from blowing wind is simple. The kinetic energy of wind, through turbines is converted into electrical energy. The

Fig. 5.5 : India – Oil Refineries

India's next agriculture revolution can happen under solar panels

How Agrivoltaics presents us a rare opportunity to decarbonize the agriculture sector and achieve Just Transition.

In September 2023, India crossed 70,000 MW solar installed capacity making it one of the 5 countries in the world to reach this milestone. But we have a long way to go. It is now crystal clear that solar will be India's energy future for day time electricity, peak time with storage, for powering electric mobility and for producing green hydrogen. We could be looking at 1500 GW by 2050 and studies even project solar capacity at 5600 GW by 2070 to achieve our Net Zero target. The deployment strategy, therefore, is of critical importance.

The focus so far has been primarily on large utility scale solar in western India and parts of the southern peninsula with better solar radiation and ostensibly barren land. The advantages of large plants have been lower generation costs, easier implementation by large companies drawing large foreign investments. Land is, however, becoming increasingly a constraint and a developing problem is the country being divided into producers and consumers which will become a crucial factor in a just transition away from coal.

India's soaring solar growth proves renewables are the future

Nishant Saxena

In a world where climate change looms as an existential threat, the importance of renewable energy cannot be overstated. A recent study by energy think tank Ember sheds light on India's remarkable contribution to global solar energy generation. The report, which analyzes electricity data from the first half of 2023, reveals that India, alongside the European Union, contributed 12% to the global increase in solar generation during this period.

In a landscape where every percentage point matters in the fight against climate change, India's substantial contribution is cause for celebration. The study considered data from 78 countries representing 92% of global electricity demand, providing a comprehensive overview of the state of renewable energy on a global scale.

Globally, solar energy accounted for 5.5% of electricity generation in the first half of 2023, marking a significant 16% increase compared to the same period last year, equivalent to an additional 104 terawatt-hours. India's solar growth was even more impressive, with a 26% increase contributing an additional 12 terawatt-hours, outpacing the global average. This substantial growth powered half of the country's increased electricity demand over the same period, demonstrating the immense potential of solar energy in meeting India's energy needs

ONGC begins 'first oil production' from deep-water block in Krishna-Godavari basin

The block will help increase ONGC's total production of oil and natural gas by 11% and 15% respectively; peak production of the field is expected to be around 45,000 barrels of oil per day and over 10 MMSCMD of gas

ONGC commencing its first oil production from
Kakinada coast on January 7.

How India is utilising non-conventional energy resources? Discuss.

permanent wind systems such the trade winds, westerlies and seasonal wind like monsoon have been used as source of energy. Besides these, local winds, land and sea breezes can also be used to produce electricity.

India, already has started generating wind energy. In Rajasthan, Gujarat, Maharashtra and Karnataka, favourable conditions for wind energy exist.

Tidal and Wave Energy

Ocean currents are the store-house of infinite energy. Since the beginning of seventeenth and eighteenth century, persistent efforts were made to create a more efficient energy system from the ceaseless tidal waves and ocean current.

Large tidal waves are known to occur along the west coast of India. Hence, India has great potential for the development of tidal energy along the coasts but so far these have not yet been utilised.

Geothermal Energy

When the magma from the interior of earth, comes out on the surface, tremendous heat is released. This heat energy can successfully be tapped and converted to electrical energy. Apart from this, the hot water that gushes out through the geyser wells is also used in the generation of thermal energy. It is popularly known as Geothermal energy. This energy is now considered to be one of the key energy sources which can be developed as an alternate source. The hot springs and geysers are being used since medieval period. In India, a geothermal energy plant has been commissioned at Manikaran in Himachal Pradesh.

The first successful (1890) attempt to tap the underground heat was made in the city of Boise, Idaho (U.S.A.), where a hot water pipe network was built to give heat to the surrounding buildings. This plant is still working.

Bio-energy

Bio-energy refers to energy derived from biological products which includes agricultural residues, municipal, industrial and other wastes. Bio-energy is a potential source of energy conversion. It can be converted into electrical energy, heat energy or gas for cooking. It will also process the waste and garbage and produce energy. This will improve economic life of rural areas in developing countries, reduce environmental pollution, enhance self-reliance and reduce pressure on fuel wood. One such project converting municipal waste into energy is Okhla in Delhi.

Conservation of Mineral Resources

The challenge of sustainable development requires integration of quest for economic development with environmental concerns. Traditional methods of resource use result into generating enormous quantity of waste as well as create other environmental problems. Hence, for sustainable development calls for the protection of resources for the future generations. There is an urgent need to conserve the resources. The alternative energy sources like solar power, wind, wave, geothermal energy are inexhaustible resource. These should be developed to replace the exhaustible resources. In case of metallic minerals, use of scrap metals will enable recycling of metals. Use of scrap is specially significant in metals like copper, lead and zinc in which India's reserves are meagre. Use of substitutes for scarce metals may also reduce their consumption. Export of strategic and scarce minerals must be reduced, so that the existing reserve may be used for a longer period.

EXERCISES

1. Choose the right answers of the following from the given options.

(i) In which one of the following States are the major oil fields located?

(a) Assam (c) Rajasthan

(b) Bihar (d) Tamil Nadu

(ii) At which one of the following places was the first atomic power station started?

(a) Kalpakkam (c) Rana Pratap Sagar

(b) Narora (d) Tarapur

(iii) Which one of the following is non-renewable source of energy?

(a) Hydel (c) Thermal

(b) Solar (d) Wind power

2 . Answer the following questions in about 30 words.

(i) Give an account of the distribution of mica in India.

(ii) What is nuclear power? Mention the important nuclear power stations in India.

(iii) Name non-ferrous metal. Discuss their spatial distribution.

(iv) What are non-conventional sources of energy?

3. Answer the following questions in about 150 words.

(i) Write a detailed note on the Petroleum resources of India.

(ii) Write an essay on hydel power in India.

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