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Another aspect of great interest in respect of drought is whether there is any periodicity in its occurrence. The power-spectrum analysis of the rainfall series and that of the Palmer drought index series show some relation to the quasi-biennial and the eleven-year sunspot cycles in some areas. The amplitude of the cycle is, however, too small to exert a significant influence.

Connected with the above points is also the problem whether the rainfall series over an area exhibits any trend, cyclic variation or persistence. A number of studies have been carried out on this aspect over different regions of the country. By and large, over the areas studied, it has been found that the rainfall series is found to be of a random nature with no significant trend. Hence it would not be feasible statistically to predict the amounts of rainfall during any particular year from a knowledge of the past rainfall occurrences alone. The probabilities of the rainfall occurrences can, however, be used to estimate the risk of poor rainfall and the attendant drought.

OVER EXPLOITATION OF WATER

The exploitation of groundwater resources more than its annual replenishment has caused the continuous declining of water levels, declining of well yield, drying of shallow wells, deterioration of ground water quality, sea water intrusion into coastal aquifers and high cost of energy required to lift the water from great depths which becomes uneconomical for poor farmers to continue agriculture.

Though India is blessed with a good water resources, but its distribution over the country is not uniform/proper. Even in the high rainfall areas like Meghalaya and Kerala water scarcity is felt in summer months due to over exploitation of water and mismanagement. There is large amount of rainfall annually flowing out as runoff to sea. The annual replenishment by groundwater resources is getting reduced due to reduction in natural recharge mechanism by man's interaction besides recurring droughts.

There is uneven distribution of water resources coupled with over utilization of groundwater resources has resulted in imbalance between recharge and development. There exists gap between available utilisable water resource and future need of water for the country. Due to over utilization of water, Punjab, Haryana, Tamilnadu and Gujarat and the states where the water tables have declined steeply. In Gujarat more than 90% wells water table dropped by 0.5 metres to 9.5 metres (CCWB). In Haryana, the average depth of ground water is fallen by 1 to 35 cm annually in different parts of the state.

CONFLICTS OVER WATER

Water being the basic requirement for life and necessary for almost all socio-economic activities is facing ever greater demand. Its relative demand increases with degree of scarcity. As we have noted above, a large part of the country already faces water scarcity conditions and it is expected that by the middle of the next century most regions of the country would face some degree of scarcity. These conditions have already created a number of inter state water dispute. If the such conditions continue, we can also expect the next world war will be on water. Bitterness over these disputes is increasing with passage of time. These water disputes have multiple facets, examples of two such instances are as :

1. Urban water demands are concentrated in space, therefore, pose serious problems at local levels. Water demands in mega cities are growing much faster than envisaged and are putting

heavy strain on water resources. It is creating difficult problem for the surrounding rural areas leading to serious conflicts.

2. Since the urban water supply are met from surface (river) flows, there will be conflicts with agricultural users, specially farmers, over the quantum of withdrawals, while the down stream users will be affected by the polluted waste waters released by urban areas. Such conflicts already exist : between Delhi and Haryana, and between Chennai and the farmers in drought prone districts of Andhra Pradesh.

In future such conflicts are likely to increase in number and escalate in magnitude unless an effective mechanism is evolved to resolve them expeditiously and judiciously.

MINERAL RESOURCES

Minerals, being the vital raw material for many basic industries, play an important role in the industrialisation and overall development of nation. Minerals are generally called the "stock" in the earth's crust. They are the non-renewable resources. Minerals are the definite chemically bonded substances created through chemical processes between organic and inorganic matters present in the earth's crust. They may be solid or liquid. Since the prosperity of a nation depends upon the proper use of minerals, hence they should be conserved and should not be misused. Govt. should promote the research in this field of mining minerals.

The history is hundreds year old from steel, copper, zinc, lead, gold, silver, cobalt etc. metals were extracted from minerals in India. But now, building materials (iron ore, manganese, gold, petroleum, natural gas, copper ore, limestone, glass sand, lead and zinc ores, chromite, pyrite, silicic acid, magnesite, gypsum, monazite, beryl, dolomite, bauxite etc. are produced from minerals in India. The minerals from metals like bismuth, cadmium, graphite, platinum, tungsten, silver, gold are extracted, are in least quantity.

Types of minerals

Minerals available in earth crust can be divided into three types

1. Metallic minerals
2. Non-metallic minerals
3. Mineral fuels

Some other classifications of minerals are also given by scientists. They are classified as strategic and critical depending on the use and importance.

1. **Metallic Minerals:** We cannot extract metal directly from minerals. There is difference between minerals and ores. Therefore, for extracting metals, minerals are treated by different processes before extraction. Metallic minerals are generally found in combined state. According to availability of metals, metallic minerals are further divided into following :-

(a) Ferrous alloys: Most common metal (which is used largely) is iron. Other than iron are aluminium, lead, zinc, copper etc. All are found in rich quantities, found in nature as well as in combined state. Iron pyrite, Lyonite, Haematite, Magnetite are examples of ferro alloys. Certain other metals, non-metals are contaminated with these as impurities.

(b) Non-ferrous alloys: The minerals/alloys of this type contain the metals like titanium, antimony, arsenic, beryllium, copper, zirconium, cerium, lithium etc. These metals are costlier than preceding metals. Here the iron found as an impurities.

(c) The minerals/alloys containing very least quantity of metals whose extraction is costlier. These metals are generally used in jewellery eg. gold, platinum, silver, iridium etc.

is of different type, i.e. Anthracite, Bituminous, Lignite etc. The type and quality of the coal depend upon the percentage of carbon present in them. It is the principal source of energy in world. It is used in various ways in different industries like cement, glass, railways, textile, sugar, paper, steel etc. It is also largely used in domestic way. USA, China, Britain, Germany, South Africa, Australia are richest coal containing countries in world.

Minerals in nature : The man is using minerals since long. From last of year back primitive man was using flint, quartz etc. for preparation of their tools. This was called "stone age". Later on using metals therefore, the period was named after as "copper age", "bronze age" and "iron age". Now present age is "machine age" because machines are prepared from minerals and they are used by mineral fields.

Molten rock materials, which is a complex collection of a number of substances, when cooled, the crystallization of different minerals takes at different temperatures. These are settled in different bands, giving the mineral deposits.

Deposits of minerals like asbestos, talc, graphite etc. are formed intense heat and pressures earth's crust.

Mineral deposits are also formed by oxidation and reduction reactions.

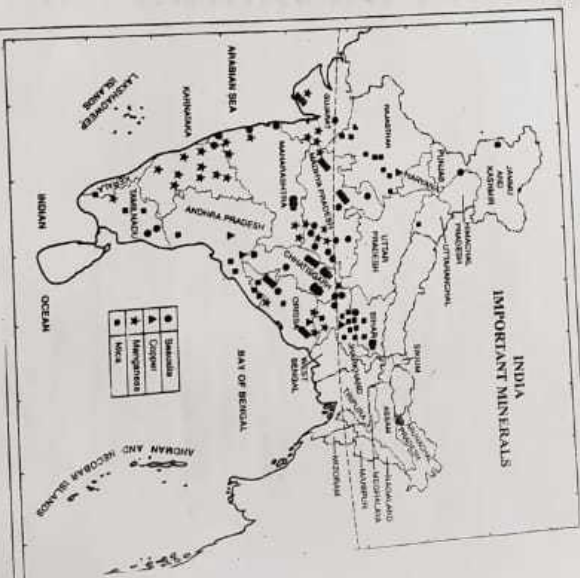
are also other views for formation of mineral deposits. When the plants, dead animals & other ecosystems are accumulated below in earth. Biological process convert them in mineral deposits.

Mineral resources of India : India has sufficient quantities of iron, aluminium, titanium, copper, lead, zinc ores. India is fairly rich in mineral resources. We possess good deposits of most of mineral elements which we needed in large quantities. However, other economically important minerals are not present in sufficient quantities. Iron minerals, which are most

Natural Fluoridation

important ingredient of today's economy are found in sufficient quantity in our country. We are presently exporting it to other countries. The similar case is for aluminium also. Oug has rich reserves. Yet among the aluminium rich countries of the world, At present we have no aluminium stock for the domestic market. We are exporting to other countries as well.

Zinc, lead and rebar in India are estimated to be about 300 million tons. Good quality steel elements minerals/ores are being depleted at a fast rate.



India has a large number of economically useful minerals and they constitute one-quarter of the world's known mineral resources. About two-thirds of its iron deposits lies in a belt along the north-eastern border. Other haematite deposits are found in Madhya Pradesh, Karnataka and Bihar border. Other haematite deposits are found in Madya Pradesh, Karnataka, Orissa and Bihar border. Magnetite iron-ore is found in Tamilnadu, Bihar and Himachal Pradesh.

India has the world's largest deposits of coal. Humintous coal is found in Jharkhand and Bihar in Bihar and Karnataka in West Bengal. Lignite coals are found in Neyveli in Tamil Nadu.

Next to Russia, India has the largest supply of **Manganese**. The manganese mining areas are Malaya Pradesh, Maharashtra and Bihar-Orissa area. **Chromite deposits** are found in Bihar, Chhattisgarh, Orissa, Krishna district in Andhra Pradesh and Mysore and Hassan in Karnataka.

Basaltic deposits are found in western Bihar, southern Kashmir, Central Tamil Nadu, and parts of Kerala, U.P., Maharashtra and Karnataka. **Chalcophyllic** deposits are found in Kerala, Andhra Pradesh and Rajasthan. **Copper** reserves are in Tamil Nadu and Rajasthan. **Nickel** ore is found in Chitkul in Bihar and Mayurbhanj in Orissa. **Ilmenite** reserves are in Kerala and along the east and the west coastal beaches.

Sillimanite reserves are in Saurashtra of Meghalaya and in Panna in M.P. **Copper** are bearing areas are Arunachal Pradesh, Andhra Pradesh, Bihar, Chhattisgarh and Jharkhand and parts of Sikkim and Karnataka.

The Karamghat field in Andhra Pradesh and Huttu in Karnataka are the important gold mines. The Panna diamond belt is the only diamond producing area in the country, which covers the districts of Jabalpur, Chhatarpur and Satna in Madhya Pradesh, as well as some parts of Bandha in Uttar Pradesh. **Derbishite** is also found in the Panna diamond belt.

Petroleum deposits are found in Assam and Gujarat. Fresh reserves were located off Mumbai. The potential oil bearing areas are Assam, Tripura, Manipur, West Bengal, Punjab, Himachal Pradesh and the Andamans.

India also possesses the all-too valuable nuclear **uranium** as well as some varieties of rare earths.

A quarter of all mining is carried out in the southern part of Orissa. Gold, silver and diamonds make up a small part of other natural resources available in India. The gemstones are found in Rajasthan. Major portion of the energy in India is generated from coal. It is estimated that India has around 120 billion tons of coal in TSSRDS, enough to last for around 120 years. Huge reserves of the petroleum have been found off the coast of Maharashtra and Gujarat and M.P. Electrical energy generated by hydroelectric power, coal and nuclear energy. Half of the hydroelectric power is generated by snow field reservoirs high up in the Himalayas. In Madhya Pradesh important minerals like diamond, tin ore, coal, copper ore, alexandrite, iron ore, dolomite, rock phosphate, manganese ore, lime stone, granite, marble, corundum, pyrophyllite, diaspore, Bauxite etc. are found in different quantities. Chhattooghat (new state of M.P.) is rich in minerals and forest products.

Environmental effects of extracting and using mineral resources

Mining, minerals and mineral based industry indeed play an extremely important role in the development of mankind. The total geographical area of India i.e. 329 million hectares constitute 2.4% of the world land area. Out of this about 82500 hectares is sustaining mining activities of same kind or the other. As the mining activity grows, the per capita availability of land is declining at a very high rate. The extra emphasis on mining and minerals is directly related to growing population and better standard of living.

The environment means the surroundings. The components of environment include soil, water, air, land, landscape and living creatures. The environment is more damaging by open cast mining than underground mining. Not only environment, mining also affects human health. Over exploitation causes the wastage of mineral wealth and derelict of land. Mineral deposits should not be over exploited because they are non-renewable. Derelict land is that land which has been abandoned as useless. Dereliction is the result of thoughtless, uncontrolled ruthless exploitation

Natural Resources

This land is the permanent damage not usable for agriculture. There are following environmental effects of mining:

- (i) Land degradation due to lowering of the surface levels at some places and creation of large ponds at other places.
- (ii) Deforestation in the mining areas, i.e. loss of valuable cover resulting in the possibility of enhancement of soil erosion.
- (iii) The loss of top and sub-soil.
- (iv) Adverse effect on ground water table. The local water table is lowered as a result of open cast mining. The replenishment of aquifers is adversely affected as the result of surface discharge of rain water is increased leaving the water-table completely or partially affected. This also increases the salinity of remaining ground water.
- (v) Due to increased discharge of rain water passing through the seams disturbed by surface mining, the local drainage system is polluted, which on joining the main drainage (canal) affects it also.
- (vi) The frequency of land slides increases substantially as a combined result of factors stated above.
- (vii) The erosion of soil is enhanced.
- (viii) The agricultural lands are affected by silt and the fine material mined but not recovered also clogs the surface water channels.
- (ix) The disturbance caused adversely affects the well-balanced pH and diminishes the regenerative qualities of soil, etc.
- (x) The disturbance caused to the floral and faunal population is immense.
- (xi) The heavy earth-moving machinery and blasting cause problems of noise, vibration and the release of noxious gases in the atmosphere.
- (xii) The aesthetic damage caused to the landscape reduces its recreational value.
- (xiii) Mine drainage has polluted streams, rivers, lakes even seas.
- (xiv) Fumes from smelters damage forests and spread pollution over large area (air pollution).
- (xv) Mining and mineral based industries with their effluents create pollution problem. Asbestos, cement and other chemical industries are very hazardous. People are supposed to live in surrounding areas.
- (xvi) Mining causes the reduction of forests i.e. deterioration. Thus flora and fauna are all destroyed. Wild life also affected. Land becomes barren and this results in increased incidence of land slides.
- (xvii) The people related with mining and extraction affected by polluted environment. Dust (poisonous gases) lead to skin and lung diseases.
- (xviii) Mining affects the sub segments of the environment like forests, vegetation, soil cover, humus and ground water. Dust and toxic gases indirectly affects air, humidity, temperature.
- (xix) Deforestation and climatic change results poor rainfall and affects flora & fauna.

WORLD FOOD PROBLEM

Before the 21st century, it was felt that world food production is not sufficient for the present population. Food production was less because people were using the old techniques, seeds, population. Later on when population pressure starts, the new ways of food production, using fertilizers, pesticides, insecticides etc. are discovered to increase the yield. In 1999 International Policy Research Institute (IFPRI) reported the increase in world food consumption by 20%.

main objectives of the product

1. **Non-metallic minerals :** Minerals, which are not metals, are other than metals comes in this head. They are called the non-metallic minerals. They are divided on the basis of physical and chemical properties. Graphite, pyrite, quartz, kaoline, flint, clay, talc, mica, asbestos, gypsum, fluorine, stones like phytic, granite, lime stone, rock, sulphur, Emerald, diamond, calcite, etc. are the examples of non-metallic minerals.

2. **Major fossil fuels :** These include the materials used to provide energy, for example coal, oil, and natural gas. These are the important source of energy, hence they have tremendous importance for mankind.

Coal is the most commonly available fuel which is used as domestic as well as industrial fuel. It is of different type i.e. Anthracite, Bituminous, Lignite etc. The type and quality of the coal depend upon the percentage of carbon present in them. It is the principal source of energy in the world. It is used in various ways in different industries like cement, glass, railways, textile, sugar, paper, steel etc. It is also largely used in domestic way. USA, China, Britain, Germany, South Africa, Australia are richest coal containing countries in world.

Petroleum is used in the manufacture of large number of petro-chemicals. It is drilled out from the sources as crude oil. Crude oil is refined before use as petrol, diesel, kerosene etc.

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The formation of mineral deposits is a very slow geo-chemical or biological process, which takes millions of years to develop mineral deposits. Most of the minerals are widely distributed in earth's crust. Studies shows that, there are number of ways by which mineral deposits are formed. They are

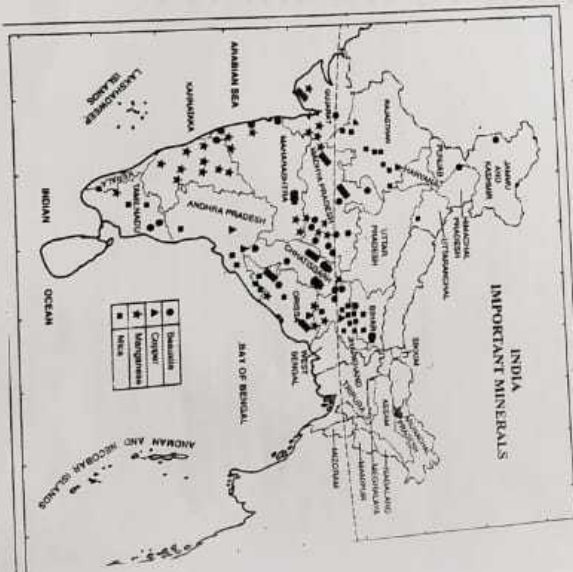
1. Molten rock materials, which is a complex collection of a number of substances, when cooled, the crystallization of different minerals takes at different temperatures. These are settled in different banks, giving the mineral deposits.
2. Sodium chloride, gypsum, salt, peter etc. Water soluble minerals are obtained by evaporation of lake-sea water. The compounds of iron and manganese as chemical sediments are also formed by precipitation from lake or sea water.
3. Deposits of minerals like asbestos, talc, graphite etc. are formed intense heat and pressures inside earth's crust.
4. When the pH, temperature, solubilities are changes, the rock materials in solution/suspension are deposited in sufficient amounts to form mineral deposits as water current slow down.
5. Mineral deposits are also formed by oxidation and reduction reactions.
6. Formation of mineral deposits are also take place by micro-organisms. It is mainly autotrophic bacteria which are involved in mineralization reactions.

There are also other views for formation of mineral deposits. When the plants, dead animals, wild life & other ecosystems are accumulated below in earth. Biological process convert them in to mineral deposits.

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Natural Resources

Important ingredients of today's economy are found in sufficient quantity in our country. We presently exporting it to other countries. The similar case is for aluminium also. Our coal ranks 7th among the aluminium rich countries of the world. At present we have sufficient aluminium stock for the domestic market. We are exporting to other countries as well. Zinc, lead ore reserves in India are estimated to be about 390 million tons. Good quality base elements minerals/ores are being depleted at a fast rate.



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- (e) Inadequate or no water
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- (c) Due to increased discharge of rain water passing through the terraces, disturbed by over-mining, the local drainage system is polluted, which on joining the main drainage leads

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heavy strain on water resources. It is creating significant problems for the cities that are not far from surface (river) flows, there will be conflict with the cities that are far from the river, while the down stream cities will be able to take advantage of the situation.

In future, such conflicts are likely to increase in number and escalate in magnitude unless a drastic *in-situ* water supply and pollution control strategy is adopted. Such conflicts arise upstream users, especially farmers, over the quantity of untreated waste waters released by urban areas. Such conflicts arise between Delhi and Haryana, and between Chennai and the farmers in trough pool districts of Andhra Pradesh.

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3. Mineral basis

Some other classifications of minerals are also given by scientists. They are classified as strategic and critical depending on the use and importance.

1. **Metalliferous Minerals:** We cannot extract metal directly from minerals. There is difference between minerals and ores. Therefore, for extracting metals, minerals are treated by different processes before extraction. Metalliferous minerals are generally found in combined state. According to availability of metals, metalliferous minerals are further divided into following:—

(ii) Ferrous alloys: Most common metal (which is used largely) is iron. Other than iron are aluminium, lead, zinc, copper etc. All are found in rich quantities, found in native as well as in combined state. Iron pyrite, lymonite, Haematite, Magnetite are examples of ferro alloys. Certain other metals, non-metals are contaminated with these as impurities.

(b) Non-ferrous alloys: The mineral alloys of this type contain the metals like titanium, antimony, arsenic, beryllium, copper, zinc, cerium, lithium etc. These metals are coarser than preceding metals. Here the iron found as an impurities.

(c) The minerals/alloys containing very least quantity of metals whose extraction is costlier. These metals are generally used in jewellery eg. gold, platinum, silver, iridium etc.

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