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3

EXOGENIC FORCES AND THEIR RESULTANT LANDFORMS

You have learnt in the previous lesson that the vertical irregularities on the earth's surface are the result of interplay between endogenic (internal) and exogenic (external) forces. The significant endogenic processes include diastrophic (slow) and catastrophic (sudden) processes. Endogenic processes are considered as constructional processes as these produce surface irregularities in the form of mountains, plateaus, depressions, faults, folds, etc. on the earth's surface. In contrast to this, exogenic processes are called as gradational or plantation processes because these are continuously engaged in wearing down vertical irregularities created by endogenic processes through denudational mechanisms (including both weathering and erosion) and depositional processes. So, the endogenic and exogenic processes are considered competing forces which are engaged in continual conflict and this continuous interactions between endogenic and exogenic processes produces complex sets of physical landscapes on the surface of the earth. These landforms are not only the physical features of the earth's surface but also the cornerstones of human civilization. The major (second order) landforms found on the earth's surface are mountains, plateaus and plains. In this lesson, we will study the exogenic forces and resultant landforms on the surface of the earth and their socio-economic importance for us.

OUTCOMES

After studying this lesson, learner

- classifes exogenic forces shaping the earth surface;
- describes weathering and gradation and their effects on landforms;
- differentiates between aggradation and degradation processes and agents;
- classifies mountains, plateaus and plains, and
- elaborates the socio-economic significance of major landforms.

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3.1 EXOGENIC FORCES: DEFINITION AND TYPES

The forces which derive their energy from the earth's exterior or originate within the earth's atmosphere are called exogenic forces (also termed as exogenetic forces) or external forces. The action of exogenic forces results in wearing down and hence they are considered as land wearing forces. The processes which occur on the surface of the earth in the influence of exogenic forces are termed as exogenic processes or exogenic geomorphic processes. The energy and material of exogenous processes are held as pools of detention and retention storage at or near the surface of the earth. The two sources of energy which power the various exogenic processes are solar radiation and the potential energy arising from the gravitational attraction of the Earth. In the absence of sufficient resisting forces, gravitational attraction of the Earth causes the downslope movement of water, ice and particles of rock and soil. Solar radiation acts in a different way, providing the energy for the evaporation of water, biological activity, and the functioning of the Earth's atmospheric circulation. Exogenic processes, including the action of water, ice and wind, predominantly involve denudation, that is, the removal of material, and thus generally lead to a reduction in elevation and relief. An exception is the localised deposition of material, to form sand dunes for instance, which causes an increase in relief.

Types of Exogenic Processes

The gradational or plantation work of the earth's surface irregularities is accomplished through (i) Degradation and (ii) Aggradation. Under the Degradation the upstanding landmass is lowered down by weathering (disintegration and decomposition and consequent downslope transfer of weathered materials), mass movement and erosional activities. This mechanism of plantation is termed as level down. In parallel to this, Aggradation is the deposition of the weathered and eroded material and this mechanism of plantation is called level up.

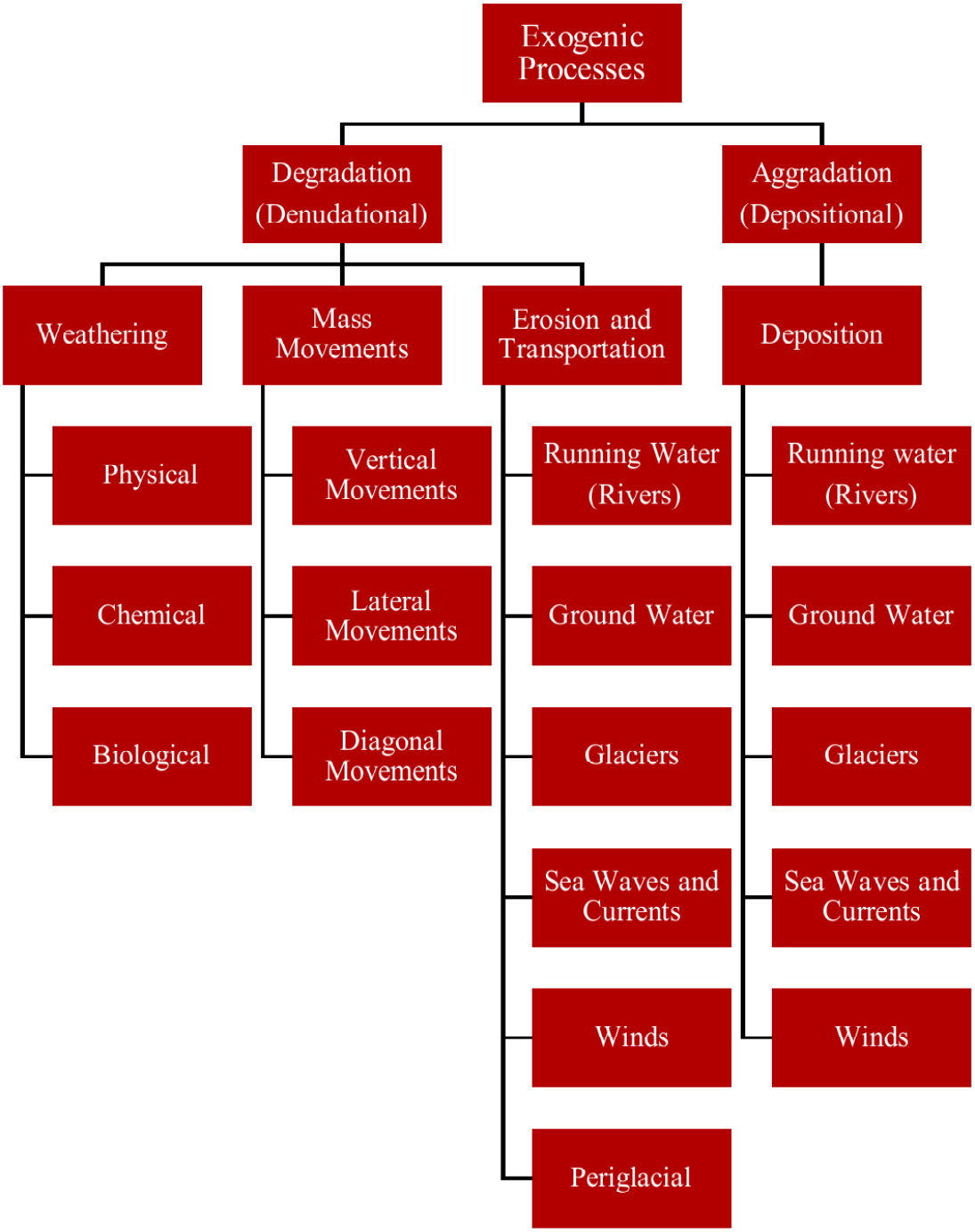

Fig. 3.1 Classification of Exogenic Processes

3.2 MECHANISM OF EXOGENIC PROCESSES

The mechanism of exogenic geomorphic processes is controlled by a number of factors. As there are different physio-climatic regions owing to variations in thermal gradients created by latitudinal, seasonal, and land-use spread on the surface of the earth, the exogenic geomorphic processes vary from region to region. The type, density and distribution of vegetation which

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largely depend upon precipitation and temperature also exert influence indirectly on exogenic geomorphic processes. Along with this, there may be local variations due to altitudinal differences, aspect variations and the variation in the amount of insolation received by north and south facing slopes as compared to east and west facing slopes. Further, due to differences in wind velocities and directions, amount and kind of precipitation, its intensity, the relation between precipitation and evaporation, daily range of temperature, freezing and thawing frequency, depth of frost penetration, the geomorphic processes vary within any climatic region. Climatic factors being equal, the intensity of action of exogenic geomorphic processes depends upon the type and structure of rocks. The term structure includes such aspects of rocks as folds, faults, orientation and inclination of beds, presence or absence of joints, bedding planes, hardness or softness of constituent minerals, chemical susceptibility of mineral constituents; the permeability or impermeability. Finally, it boils down to one fact that the differences on the surface of the earth though originally related to the crustal evolution continue to exist in some form or the other due to differences in the type and structure of earth materials, differences in geomorphic processes and in their rates of operation. Some of the exogenic geomorphic processes have been dealt with in detail here.

3.3 WEATHERING AND MASS WASTING

Weathering is the action of elements of weather and climate over earth materials. There are several processes within weathering which act either individually or together to affect the earth materials in order to reduce them to fragmental state. It is an in-situ or on-site process, as very little or no motion of materials takes place in weathering. The process of weathering is conditioned by many complex geological, topographic, climatic, and vegetative factors. Climate played the most vital role. There are three major groups of weathering processes:

i. Physical or Mechanical

ii. Chemical and

iii. Biological weathering processes.

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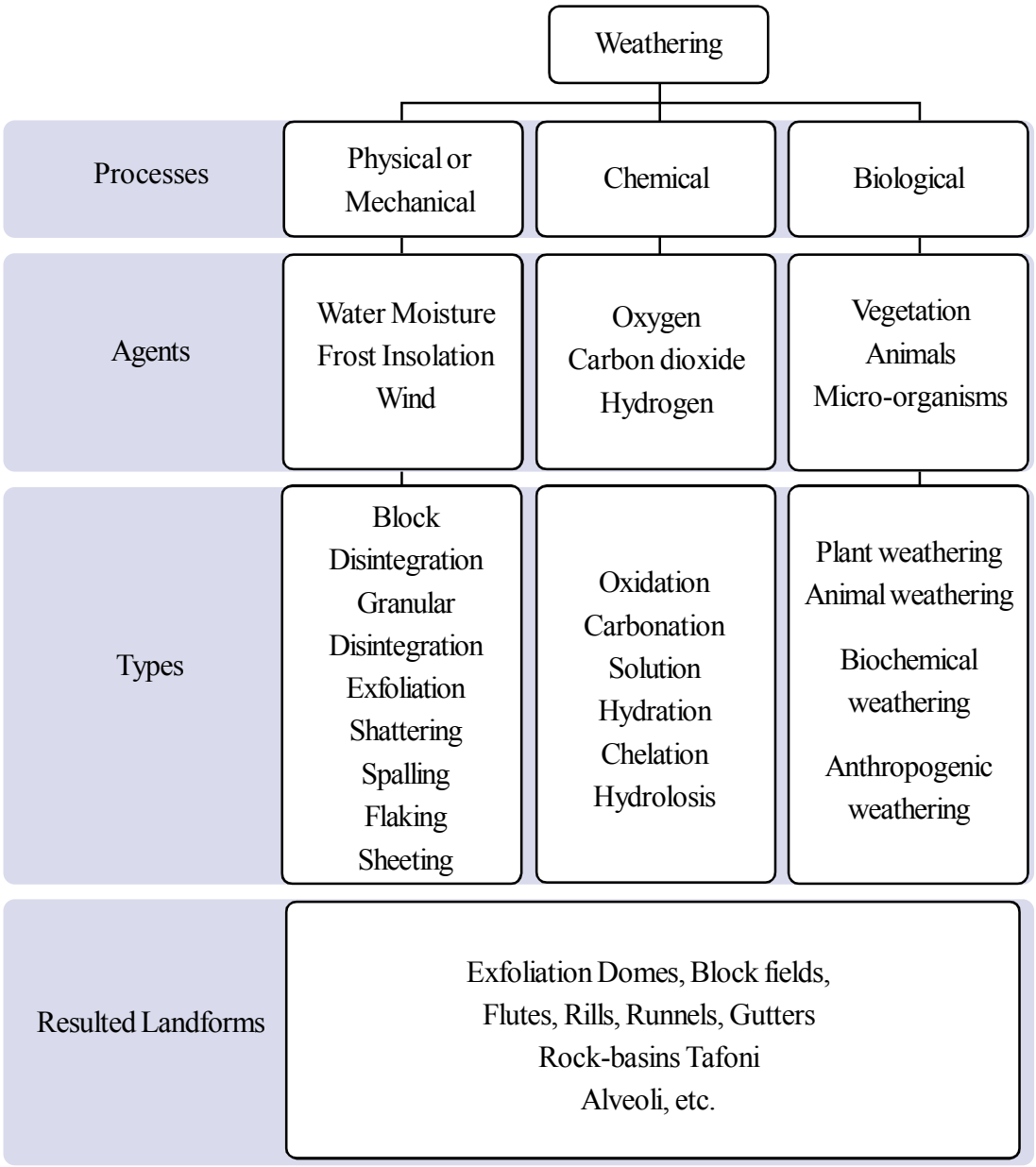

Fig. 3.2 Weathering: Processes, agents, and types

Generally, the process of weathering is the complex result of all these phenomena. It is very rare that these processes ever operate completely by itself, but dominance of one process can be seen quite often. Physical or mechanical weathering can be considered as the disintegration of rock masses into blocks, boulders, cobbles and pebbles, sands, and silts due to variation in temperature, frost action, wind action and unloading of superincumbent pressure. Chemical weathering is the disintegration and decomposition of rock masses due to chemical responses. Oxidation, solution, hydration, carbonation, chelation, and hydrolysis, etc. are the most recognized chemical reactions which affect the chemical composition of the rock masses. Apart from the mechanical and chemical reactions, biological agents also affect the rock's structure which includes floral (physical and chemical both), faunal (burrowing animals, worms

and other organisms), and anthropogenic (mining, blasting of hills for road and dam construction, quarrying for building and industrial material, deforestation, agriculture and many more).

Fig. 3.3 Weathering products: Landforms.

Mass Movements

Disintegrated and fragmented material due to the mechanism of weathering processes (mechanical, chemical, or biological) is called debris or rock-wastes. Generally, movement of this waste material down the hill slope under the influence of gravity is called mass movement or mass wasting. The sliding or flowing of weathered materials ranging from very fine (soils) to very coarse and large sized rock materials (boulders) is due to their position and to gravitational forces, but mass movement is accelerated by presence of water, ice, and air.

Table 3.1

Classification of Mass movements

Direction of movement	**Vertical**		**Lateral**		**Diagonal**		
Type of movement	Fall	Subsidence	Slide	Spread	Creep	Slide	Flow
Presence of transporting agent	No	No	Minor in basal layer	Moderate in basal layer	Minor	Minor to moderate	Major
Type of mass movement	Rock fall, Earth-fall, Topple	Collapse settlement	Block slide	Spread cambering	Soil creep, Rock creep, Talus creep	Rock slide, Debris slide, Soil slip, Slump	Solifluction, Mudflow, Rock Glacier, Rock avalanche

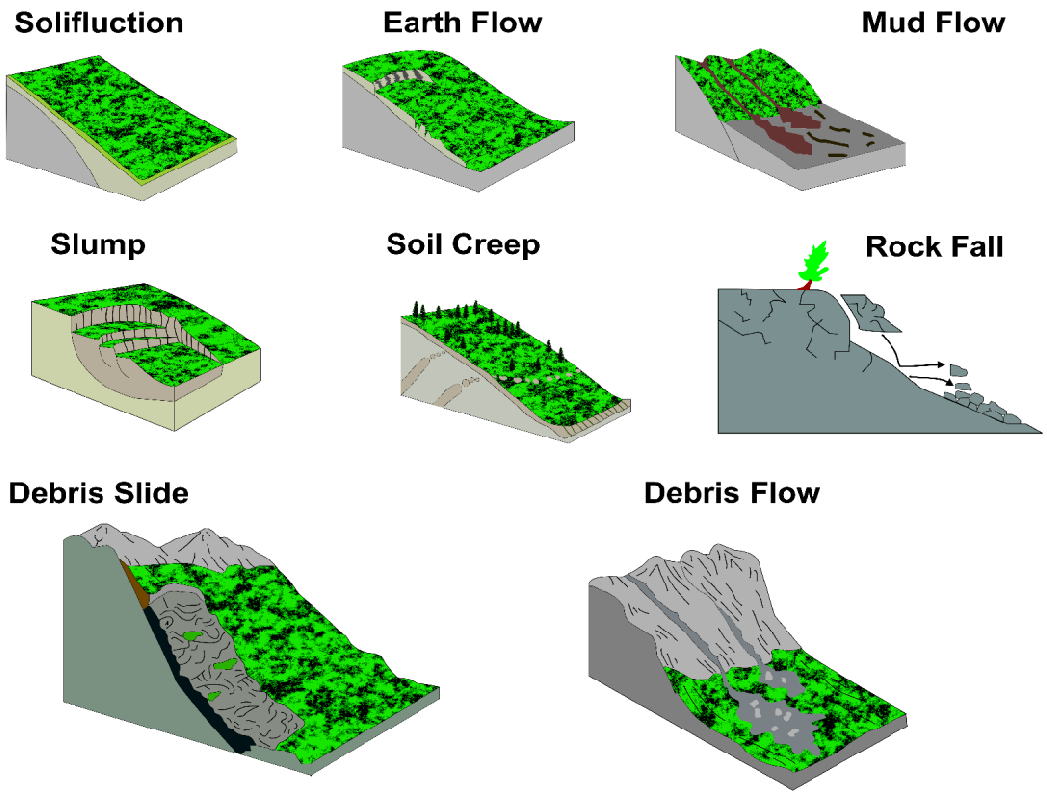

Fig. 3.4 Different types of Mass movements

3.4 EROSION, TRANSPORTATION AND DEPOSITION

Exogenic processes are generally called erosional processes which perform three-phase work i.e. erosion, transportation and deposition. Erosion is the acquisition and transportation of rock debris by geomorphic agents like running water, the wind, waves, glaciers, etc. Though weathering aids erosion, it is not a precondition for erosion to take place. (i.e., erosion can take place in unweathered conditions also). The deposition is a consequence of erosion, as erosional agents lose their velocity and energy on gentle slopes and materials carried by them start to settle themselves.

The erosional work by different processes is performed through the mechanism of:

a. Corrasion or Abrasion

b. Corrosion or solution

c. Attrition

d. Hydraulic action

e. Deflation

f. Periglacial erosional processes (Nivation, Congelifraction, etc.)

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a. Corrasion or Abrasion involves the removal of loosened materials of the rocks by different erosional processes in different manner. Erosion tools refer to all those solid materials (boulders, cobbles, pebbles, sands etc.) with the help of which erosional agents attack and abrade the rocks. The degree of abrasion depends on a host of variables, e.g. nature of erosional agents such as rivers, groundwater, sea-waves, glacier, wind etc., nature of erosion tools, nature of geomaterials, force of erosional processes, gradient etc.

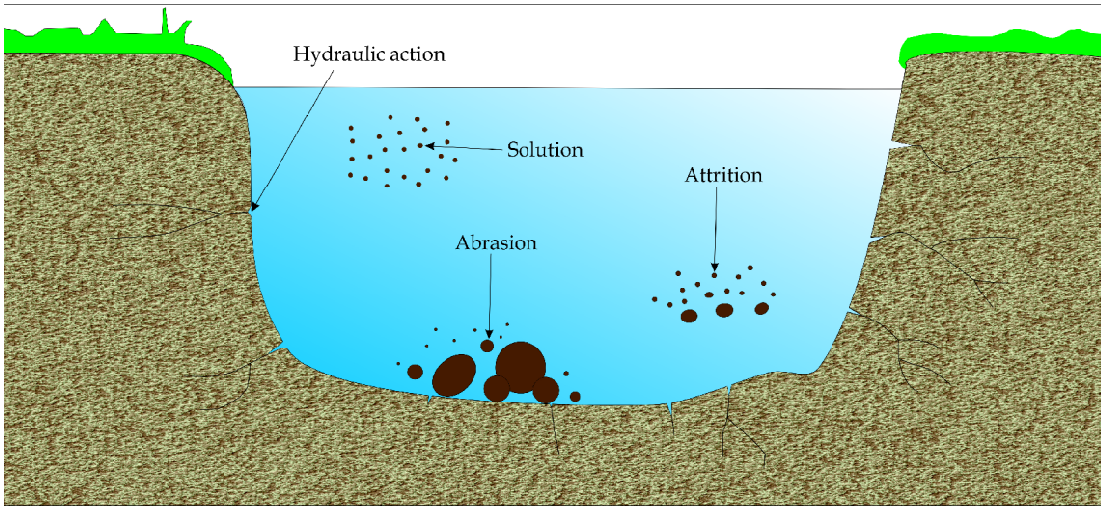

Fig. 3.5 Types of erosional processes

b. The mechanism of corrosion involves dissolution of the soluble materials through the process of disintegration and decomposition of carbonate rocks, which is effectively corroded by running water, groundwater and sea waves.

c. Attrition refers to mechanical tear and wear of erosion tools suffered by themselves. The boulders, cobbles, pebbles etc. while moving downstream with water collide against each other and thus are fragmented into smaller and finer pieces in the transit. Attrition by wind involves mechanical breakdown of rock particles while they are transported by wind through the processes of saltation and surface creep.

d. The breakdown of rocks due to pressure exerted by water currents of the rivers and sea waves is termed as Hydraulic action. It is the mechanical loosening and removal of materials of rocks by water alone without the help of erosion tools. The rivers erode their valley walls through hydraulic action.

e. Deflation is the process of removing, lifting and blowing away dry and loose particles of sands and dust by winds. It happens in semi-arid or arid regions. Congelifraction (frost weathering), Congelifluction (soil creep), nivation (snow patch erosion), etc. are significant weathering and transportation mechanisms performed by periglacial agents.

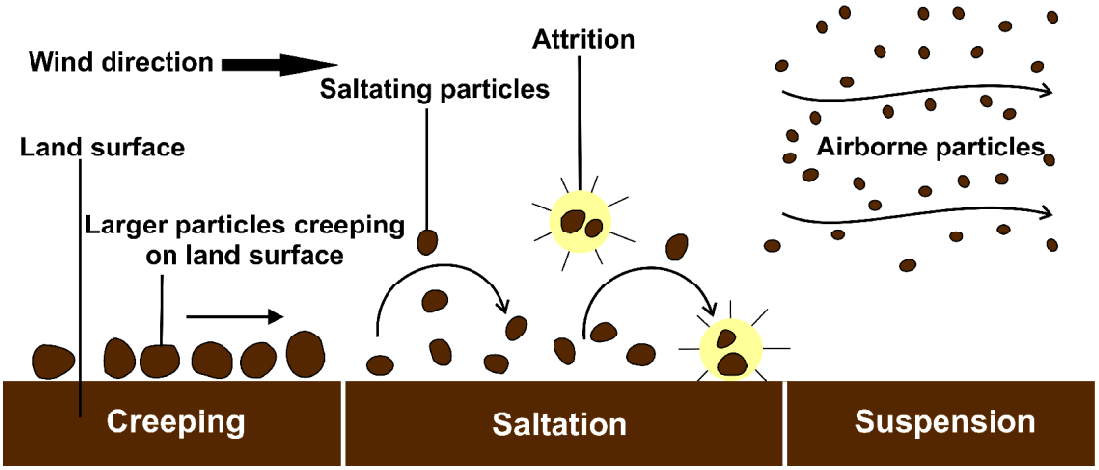

Fig. 3.6 The process of erosion and transportation by wind

The transportation work by different geomorphic processes is accomplished through flotation, suspension, traction, saltation, solution etc. such as running water (rivers) transports sediments through traction, saltation, suspension and solution. The mechanism of saltation is extremely slow, involves the transport of load with water currents wherein coarse load moves downward by leaping and jumping through valley floors. The downstream movement of loose materials on the valley floor is called traction. The bed-load being transported by traction method consists of gravels, pebbles, cobbles and boulders. The materials of medium size are suspended in water due to buoyancy.

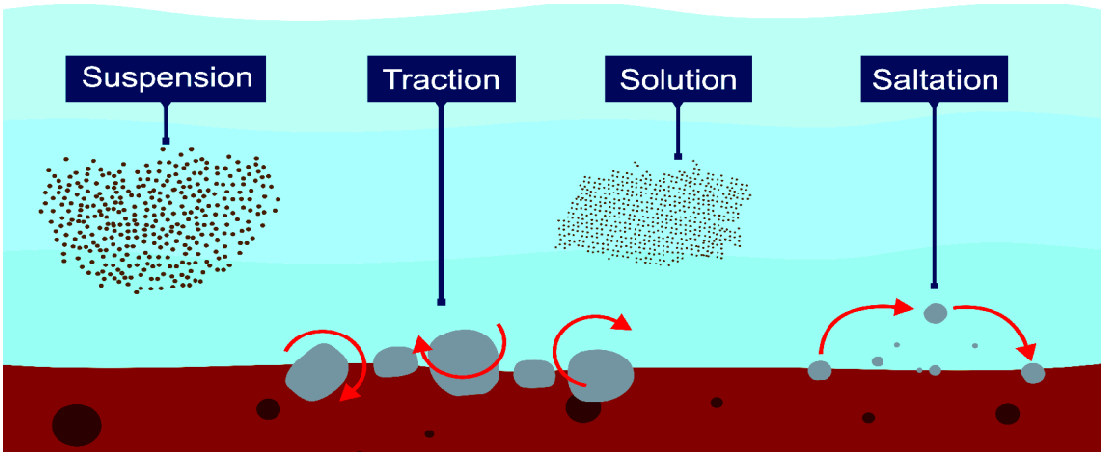

Fig. 3.7 Four ways of transportation in a river

The transportation by streams is unidirectional (downstream). The soluble materials are dissolved in water and become invisible and are transported downstream in solution, which is prominent in groundwater transports. The transportational work of sea waves varies significantly from other agents of erosion and transportation. For example, the backwash (towards sea) currents pick up the eroded materials and transport them seaward but the up rushing breaker waves or surf currents pick up these materials and bring them again to the coasts and beaches. The transportational work of wind differs significantly as wind-transportation

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is multi-directional. Wind transport involves entrainment of loosened grains of sands and dust in the air and their movement to new locations. Only very fine materials are transported to greater distances in one step while coarser materials are transported in stages and steps by rolling, leaping and jumping. Glacial sediments (glacial drifts) are transported along the sides and floors of the glacial valleys and snouts of the glaciers. The debris falling directly into the glacier is transported without touching the bottom of the glacier while the debris falling onto the surface of a glacier is transported down slope with the moving ice mass.

The process of transportation of eroded material is followed by the depositional work which is affected by a variety of factors depending on the agents of erosion and material eroded. For example, the deposition of load carried by the streams is affected by decrease in channel gradient, decrease in stream velocity, obstruction in channel flow, increase in sediments load, etc. Depositional work by groundwater takes place when solvent (water) becomes oversaturated. As the chemical erosion of carbonate rocks continues, the groundwater or say solvent receives more and more solutes and becomes saturated with dissolved sediments and it cannot transport enough sediments. Thus, chemical erosion and sedimentation (deposition) take place together. Deposition by marine processes (sea waves or currents) is most variable and temporary in character because breakers or surf currents abrade the coasts and backwash currents and rip currents bring them seaward and deposit at the lower segments of wave-cut platforms. These sediments are again picked up by surf currents and breakers and are brought to the coasts. Thus, marine sediments are reworked by sea waves again and again.

Depositional work by wind is geomorphologically very important because significant features like sand dunes and loose arcs are formed. Deposition of windblown sediments occurs due to marked reduction in wind speed and obstructions caused by bushes, forests, marshes and swamps, lakes, big rivers, walls etc. The debris carried by glaciers arc collectively called as glacial drifts which include till, ice-contact stratified drift, outwash etc. The unsorted and unstratified glacial drifts are called tills which are further divided into (i) basal till and (ii) ablation till. The glacial deposition is generally called moraine.

INTEXT QUESTIONS 3.1

1. Name the two major sources of energy which empower the various exogenic processes.

   (i) _____(ii) _____

2. Classify the degradational or denudational exogenic processes.

   (i) _____

   (ii) _____

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(iii) _____

3. By which process rivers erode their valley walls?

_____

4. Name the process of removing, lifting and blowing away dry and loose particles of sands and dusts by winds, in semi-arid or arid regions.

_____

5. Name the debris carried by glaciers.

_____

3.5 RESULTANT MAJOR LANDFORMS

The mechanism of the endogenic and exogenic operations (erosional and depositional work) is different from one another and hence the landforms produced by each process may be differentiated. Thus, on the basis of dimension and scale, the relief features of the earth's surface may be grouped in three broad categories of descending order. On the smallest scale and covering the largest area is world geomorphology which includes consideration of continents and ocean basins. The consideration and interpretation of worldwide erosion surfaces requires the description and analysis of the characteristics and evolution of continents and ocean basins. Thus, continents and ocean basins become the relief features of the first order. The structural forms developed over a continent or ocean basins as mountains, plateaus, plains, lakes, faults, rift valleys etc. constitute the category of relief features of the second order. These forms owe their genesis mainly to endogenetic forces, particularly diastrophic forces but shaped and developed through exogenic forces. Micro-level landforms developed on these second order relief features by exogenic degradational and aggradational processes originating from the atmosphere dominate in this category, called third order landforms. These landforms may be erosional (e.g. river valley, glacial valley, karst valley, terraces, cirques, canyons, sea cliffs, etc.), depositional (e.g. flood plains, bars, eskers, delta, sea beaches, sand dunes, stalactites, stalagmites, tufa, etc.), residuals (e.g. inselbergs) and sometimes minor tectonic features (by endogenetic forces).

The micro-level landforms will be discussed in the next lesson. In this lesson, the major landforms (second order) of the earth surface, mountains, plateaus, and plains will be explained in detail.

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3.6 MOUNTAINS

Mountains are the most awe-inspiring landform on the surface of the earth. A mountain is an elevated portion of the Earth's crust, generally with steep sides that show significant exposed bedrock, which covers around 27% of the total earth's surface. A mountain differs from a plateau in having a limited summit area, and is larger than a hill. A few mountains are isolated summits, but most occur in mountain ranges. There is no universally accepted definition of a mountain. Elevation, volume, relief, steepness, spacing and continuity have been used as criteria for defining a mountain. According to the Oxford English Dictionary, a mountain is defined as "a natural elevation of the earth surface rising more or less abruptly from the surrounding level and attaining an altitude which, relative to the adjacent elevation, is impressive or notable."

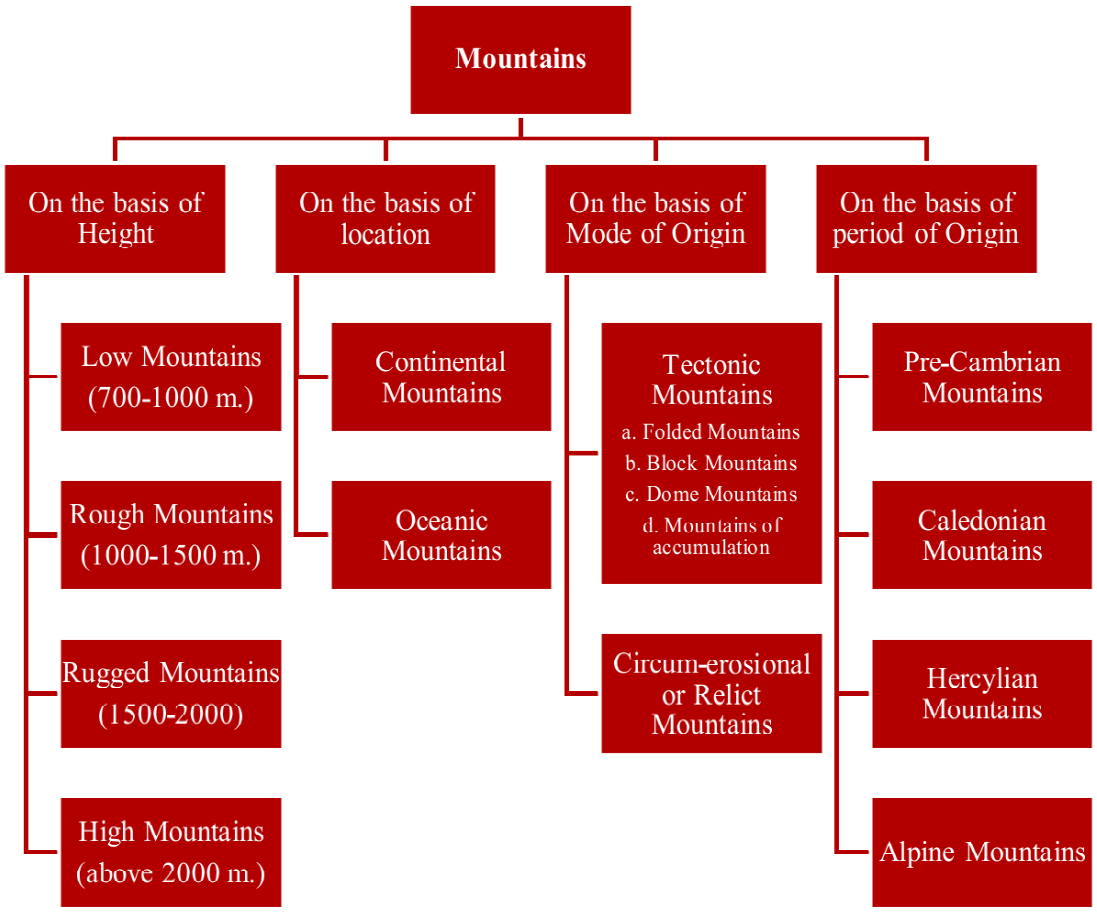

Fig. 3.8 Classification of Mountains

On the basis of their mode of origin, the mountains have been classified as:

a. Folded Mountains

Folded mountains are formed due to folding of crustal rocks by compressive forces generated by endogenetic forces coming from within the earth. These are the highest and most extensive mountains of the world and are found in all the continents. Rockies, Andes, Alps, Himalayas, Atlas etc. are the examples of folded mountains.

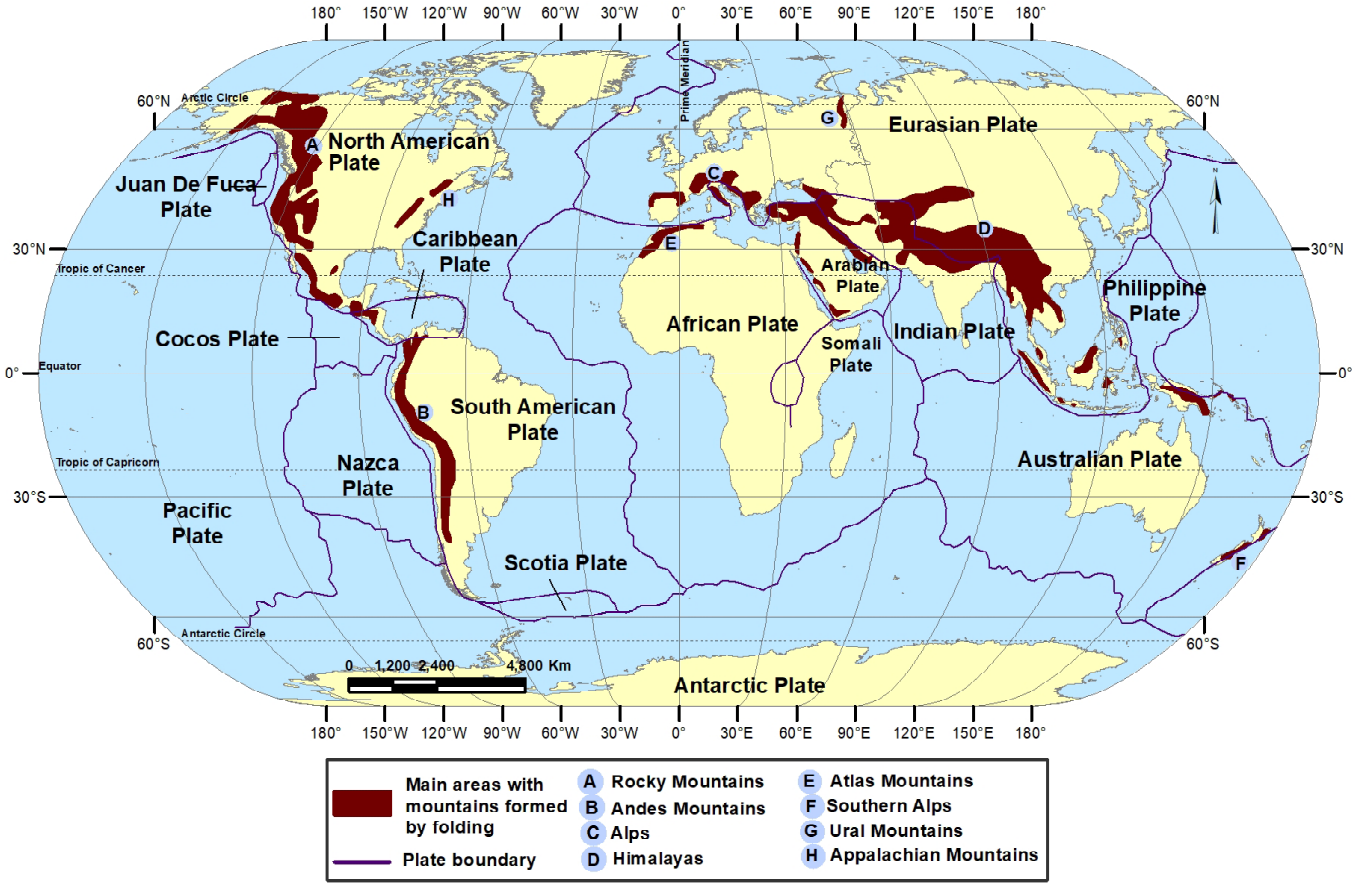

Fig. 3.9 Distribution of Important Fold Mountains of the World

Block Mountains

Block mountains are the result of faulting caused by tensile and compressive forces motored by endogenetic forces coming from within the earth. Block mountains represent the upstanding parts of the ground between two faults or on either side of a rift valley or a graben. Essentially, block mountains are formed due to faulting in the ground surface. They are also called horst mountains. The Vosges in France, Black Forest Mountains in Germany are the typical examples of block mountains.

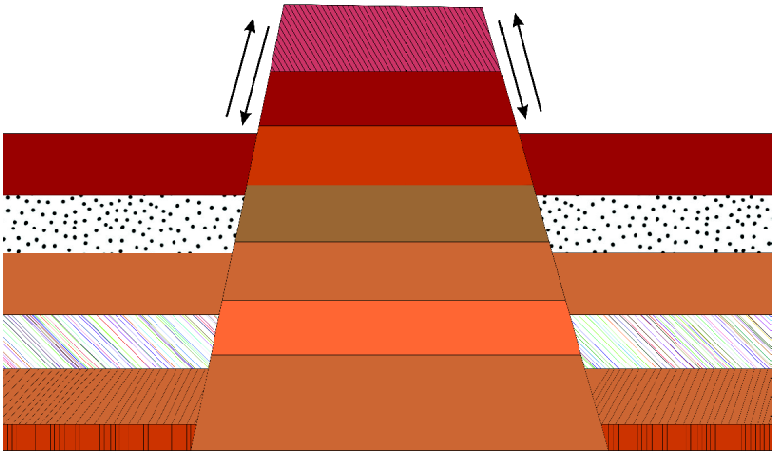

Fig.3.10 (a) Formation & Block Mountains

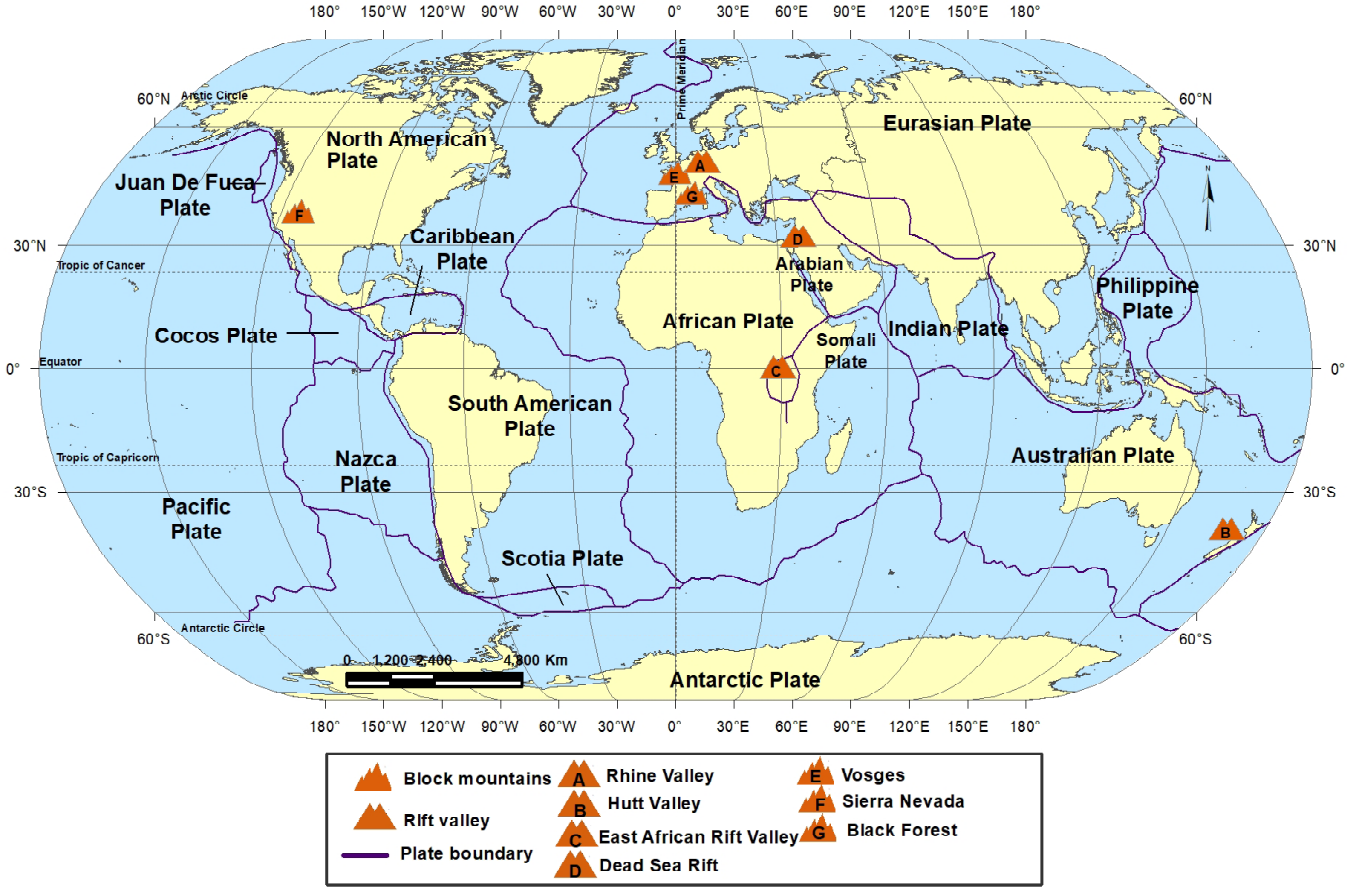

Fig.3.10 (b) Formation of Block Mountains

b. Dome Mountains

These mountains are originated by magmatic intrusions and upwarping of the crustal surface. Examples: normal domes, lava domes, batholithic domes, laccolithic domes, salt domes etc. Typical example of domed mountain is Weald in southeast England.

c. Mountains of Accumulations

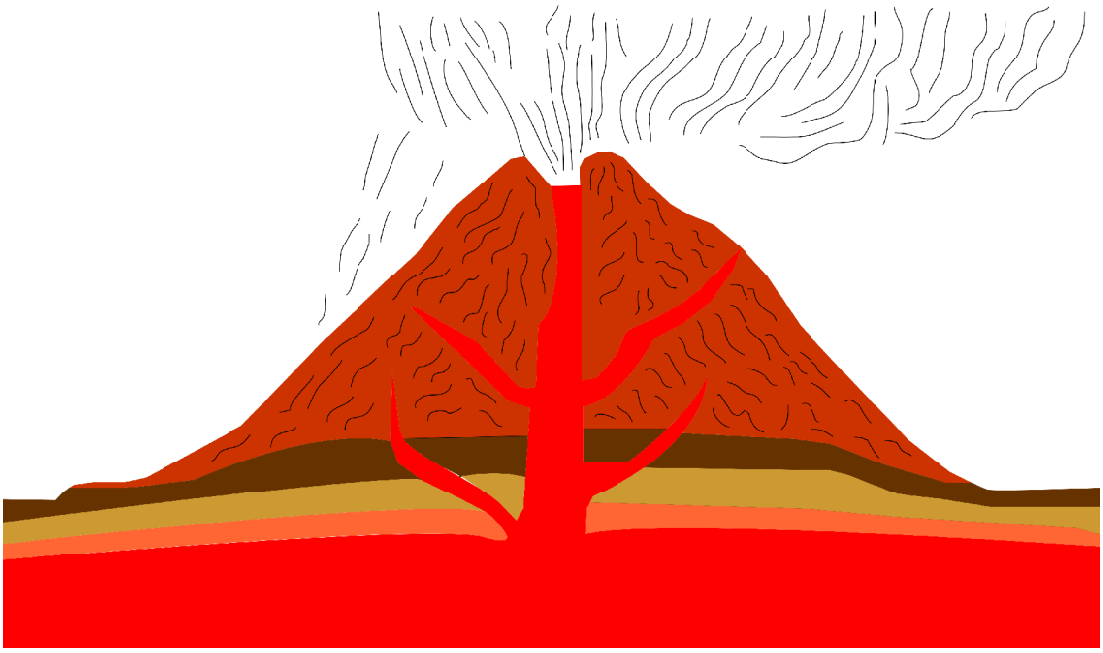

Fig. 3.11 Formation of Volcanic Mountains.

These mountains are formed due to accumulation of volcanic materials. Thus, these are also called volcanicc mountains. Different types of volcanic cones (e.g. cinder cones, composite cones, acid lava cones, basic lava cones etc.) come under this category. Mount Mauna Loa in Hawaii Islands, Mount Popa in Myanmar, Vesuvius in Italy, Cotopaxi in Ecuador and Fuji Yama in Japan are examples of volcanic mountains.

d. Circum-erosional or Relict or Residual Mountains

Fig.3.12 Aravalli Range, India

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As soon as an elevated mountain range appears on the earth's surface due to internal forces, the agents of gradation begin their work of levelling it down. To a large extent, the process of wearing down depends on the shape and structure of the rocks. After thousands of years, soft rocks are worn down into sand and the hard rocks are left standing up in the area that has been reduced in height. These are called relict or residual mountains. Hills like the Nilgiris, the Parasnath, the Rajmahals and the Aravallis in India are examples of residual mountains.

The Significance of Mountains:

Mountains are useful to us and nature in the following ways:

a. Storehouse of Resources

Mountains are the storehouse of natural resources. Large resources of minerals are found in mountains. The Appalachian range in the United States is well-known for coal and limestone deposits. We get timber, lac, medicinal herbs and wood for making pulp from the forests of the mountains. Tea and coffee plantations and some fruit orchards have been developed on mountain and hill slopes of Himalayas and western ghats in India.

b. Abundant Sources of Water

Perennial rivers rising in the snow fed or heavily rain fed mountains are the important source of water. They help in promoting irrigation and provide water for many other uses. For example, The Himalayas is the source of many perennial rivers in India and adjoining nations like Ganga, Yamuna, Brahmaputra, Indus, Sutlej, etc.

c. Generation of Hydro-electricity

Hydro-electricity is generated from the waters of perennial rivers in the mountain regions. The mountainous countries like Japan, Italy and Switzerland, which suffer from the shortage of coal have developed hydro-electricity.

d. Formation of Fertile Plains Downstream

The rivers that originate in the high mountain region bring silt along with water to the lower valleys. This helps in the formation of fertile plains. The great alluvial plain of northern India has been formed by the rivers Ganga, Sutlej and the Brahmaputra and their tributaries.

e. Hotspots for Biodiversity

As half of the world's biodiversity hotspots are concentrated in mountains and mountains support approximately one-quarter of terrestrial biological diversity. Mountains are home to rare animals such as gorillas, snow leopards and the majestic tahr as well as strikingly beautiful plants such as orchids and lobelias.

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f. Home of numerous Indigenous people

As many mountain areas host ancient indigenous communities that possess and maintain precious knowledge, traditions and languages. Mountain peoples have developed remarkable land use systems and have a wealth of knowledge and strategies accumulated over generations on how to adapt to climate variability. For example, Bakarwals, Bhotias, Tharu, Lepchas and Mishmis of Himalayas.

g. Natural Political Frontiers

The mountain ranges do act as natural political frontiers between countries and protect them from invasions to some extent. The Himalaya has formed a political frontier between India and China.

h. Influence the Climate

Mountainous areas have lower temperatures. They serve as a climatic divide between two adjoining regions. The Himalaya for example forms a barrier to the movement of cold winds from Central Asia towards the Indian subcontinent. They also force the South West Monsoons to ascend and cause rainfall on their southern slopes.

i. Major Tourist Attractions

Mountains are also becoming recreational refuges from crowded cities for the tourists. The pleasant climate and the beautiful scenery of the mountains have led to their development as centres of tourist attraction. The tourist and hotel industries get additional encouragement in such regions. Shimla, Nainital, Mussoorie, Gangtok Srinagar etc are some of the important hill stations of India which attract tourists all over the world.

j. Sacred landforms on the Earth

For more than one billion people, mountains are sacred places. Their soaring summits, the clouds and thunder that swirl about their peaks, the life-giving waters that flow from their heights, these and other characteristics imbue them with an aura of mystery and sanctity. Mount Kailash, Mount Fuji etc are some of the examples which are important for different religion.

3.6 PLATEAUS

Plateau or Plateaus is an extensive area of flat upland usually bounded by steep slopes on all sides but sometimes enclosed by mountains. The essential criteria for plateaus are low relative relief and some altitude. It covers about 18% of the earth's surface. This landform has a large elevated area on its top unlike a mountain and has nearly an even surface out there. Very often rivers or streams cut out deep valleys and gorges in a plateau region which transforms its

original smooth topography into a dissected plateau. The vertical expansion is normally 600 metres above sea level, but there are also plateaus of Tibet and Bolivia, more than 3600 metres above sea level. On the basis of their geographical location and structure of rocks, the plateaus can be classified as:

a. Intermontane Plateaus

b. Piedmont Plateaus

c. Continental Plateaus

a. Intermontane Plateau

The plateau which are bordering the fold mountain range or are partly or fully enclosed within them are the intermontane plateaus. Vertical movements raise this extensive landform of nearly horizontal rocks to thousands of metres above sea level. The extensive and over 4500 metres high plateau of Tibet is one such example. It is surrounded by folded mountains like Himalaya, Karakoram, Kunlun, Tien Shan on its two sides. The plateau of Colorado is another well-known example, over one km high into which rivers have cut the Grand Canyon and a series of gorges. The plateau of Mexico, Bolivia and Iran are all other examples of this type & platines.

b. Piedmont Plateau

The plateaus that are situated at the foot of the mountains and are bounded on other sides by a plain or an ocean are called piedmont plateau, The plateau of Malwa in India, Patagonia facing the Atlantic Ocean and the Appalachians situated between the Appalachian Mountain and the Atlantic Coastal Plain in U.S.A are their examples. In their case, the areas once high have now been reduced by various agents of erosion. For this reason, these are also called the plateaus of denudation.

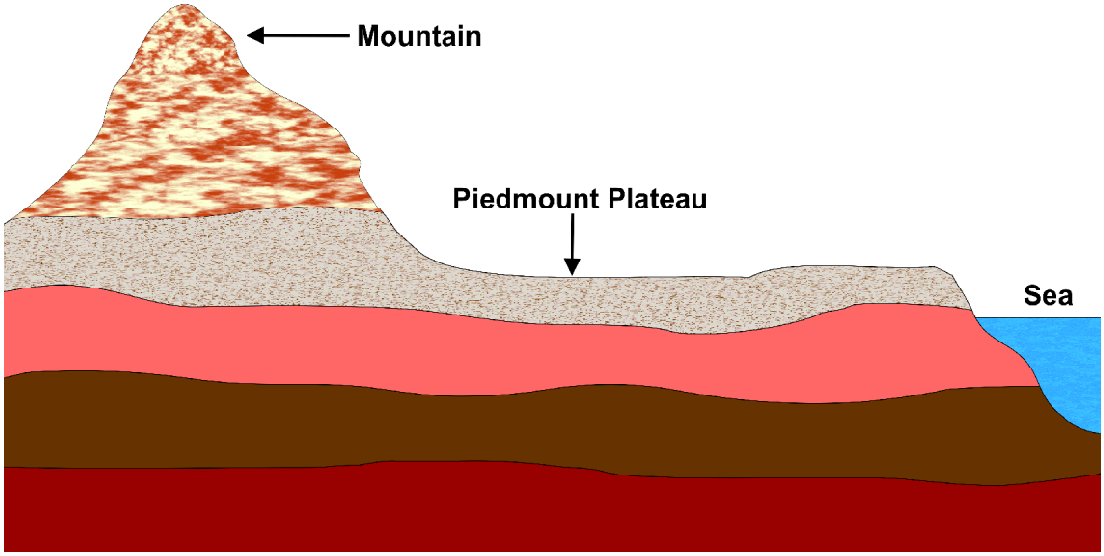

Fig.3.14 Piedmont Plateau

c. Continental Plateau

These are formed either by an extensive continental uplift or by the spread of horizontal basic lava sheets completely covering the original topography to a great depth. The volcanic lava covered plateau of Maharashtra in India; Snake River Plateau in North West USA are the examples of this type. These are also called the plateau of accumulation. All continental plateaus show an abrupt elevation in contrast to the nearby lowland or the sea. As compared to others, these plateaus cover a vast area like the Great Indian Plateau and those of Arabia, Spain, Greenland, Africa and Australia. They may be tilted on one side without any disturbance in the horizontal nature of underlying rock strata as in the case of the Great Indian plateau.

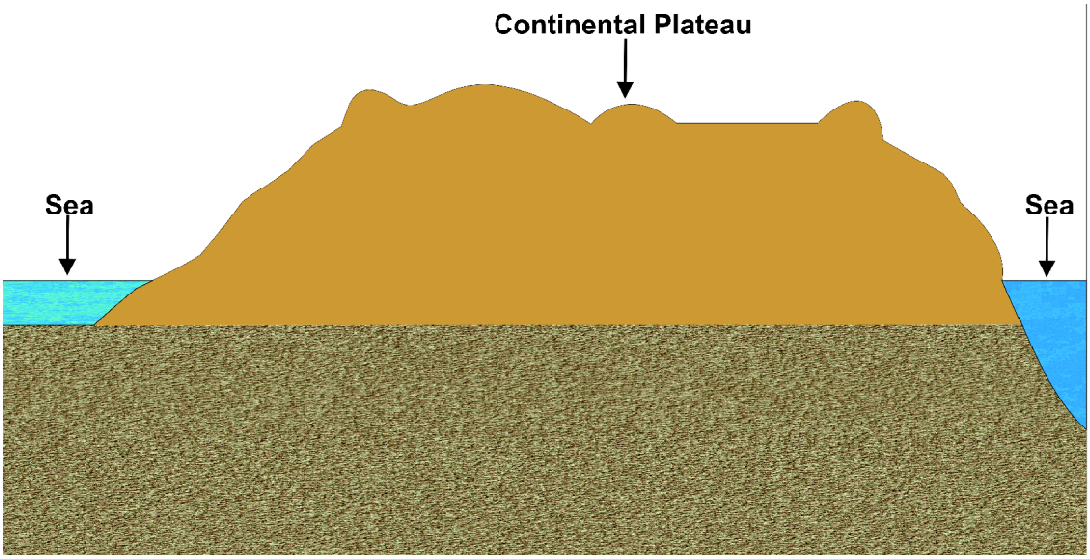

Fig.3.15 Continental Plateau

The Significance of Plateaus

i. Storehouse of Minerals

Most of the minerals in the world are found in the plateaus. Besides, the extraction of minerals is relatively easier on plateaus. These minerals are indispensable as raw material for our industries. We get gold from the Plateau of Western Australia; copper, diamonds and gold from the Plateaus of Africa and coal, iron, manganese and mica from the Chota Nagpur Plateau in India.

ii. Birthplace of various waterfalls

Plateaus are also the source of several waterfalls. These waterfalls provide ideal sites for generating hydel-power. In India, two important waterfalls in the plateau regions are Hundru falls in the Chota Nagpur plateau on the river Subarnarekha and the Jog falls in Karnataka on the river sharavati.

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iii. Cool Climate

The higher parts of the plateaus even in tropical and subtropical regions have cool climates. Hence, they have attracted Europeans to settle there and develop their economy e.g. South and East Africa.

iv. Useful for Agriculture and Animal-rearing

The lava plateaus that are formed due to volcanic eruptions have black fertile soil, which is suitable for cultivation. Plateaus have large grassland areas suitable for animal-rearing specially sheep, goat and cattle. They provide a variety of products such as wool, milk, meat and hide or skin.

v. Tourist attraction

Most plateaus have scenic spot-like features which act as tourist attraction sites. The grand cannons, as well as the numerous waterfalls which are found in most high plateaus, are the perfect examples of tourist attraction features on plateaus. With the attractions, the residents of such areas can earn foreign revenues from the sites.

3.7 PLAINS

Plains are the most important landforms found on the earth's surface. A low-lying relatively flat or slightly rolling land surface with very gentle slope and minimum local relief is called a plain. Plains occupy about more than one-third of the earth's surface. Most of the plains have been formed by the deposition of sediments brought down by rivers. Besides rivers, some plains have also been formed by the action of wind, moving ice and tectonic activity. Plains have an average height of less than 200 metres.

On the basis of their mode of formation, plains can be classified into the following types:

a. Structural plains

b. Erosional plains

c. Depositional plains.

a. Structural Plains

These plains are mainly formed by the uplift of a part of the sea-floor or continental shelf. These are located on the borders of almost all the major continents. The south eastern plain of the United States formed by the uplift of a part of the Gulf of Mexico is an example of this type of plain. The structural plains may also be formed by the subsidence of areas. One such plain is the central low-lands of Australia.

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b. Erosional Plains

These plains are formed by the continuous and a long-time erosion of all sorts of upland. The surface of such plains is hardly smooth. These are therefore also called peneplains which means almost a plain. The Canadian shield and the West Siberian plain are examples of erosional plains.

c. Depositional Plain

Fragments of soil, regolith, and bedrock that are removed from the parent rock mass are transported and deposited elsewhere to make an entirely different set of surface features–the depositional landforms. The type of depositional plains depends on the geomorphic agents of deposition. Plains formed by river deposits are called riverine or alluvial plains. The Indo-Gangetic plain of the Indian subcontinent, the Hwang-Ho Plain of North China and the Ganga-Brahmaputra Delta Plain in Bangladesh are examples of alluvial plains. Deposition of sediments in a lake gives rise to a lacustrine plain or a lake plain. The Valley of Kashmir and that of Manipur are examples of two most prominent lacustrine plains in India. When plains are formed by glacial deposits, they are called glacial or drift plains. Plains of Canada and North-Western Europe are examples of glacial plains. In the semi-arid and arid regions Loess plains are the results when wind is the major agent of deposition. Loess plains of North- Western China are formed by the deposits of loose air-borne fine dust particles.

The Significance of Plains

The plains have influenced the human life in the following ways:

a. Most Fertile Soil

The plains generally have deep and fertile soil. Since the plains have a flat surface, the means of irrigation are easily developed. Both these factors have made the plains agriculturally so important that they are often called 'food baskets of the world'.

b. Improved transport and communication system

Being a level or flat land, plains are ideal for constructing roads and railways. Waterways (rivers) can also be used as a mode of transport, thereby leading to a developed system of transport and communication.

c. Favourable climate

Compared to mountains and plateaus, the climate is quite pleasant in the plains. Temperature is not extreme here and rainfall is also suffecient at many plain.

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d. Development of industries

Flat land, pleasant climate, developed transport and communication system, availability of labour (the plains being a densely populated area), availability of raw materials, etc., have all contributed to the development of industries in the plains.

e. Centres of Civilizations

The flat land, fertile soil, developed transport and communication system, conducive climate, opportunities of employment, etc., have all led to the growth of settlements followed by civilizations. The major river valley civilizations of the world have flourished in the plains only. Hence, they are aptly referred to as the cradles of civilization. For example, there are the civilizations of the Indus and the Nile Valley.

INTEXT QUESTIONS 3.2

1. Name the three major landforms of second order found on the earth's surface.

   (i) (ii) (iii)

2. Block mountains are the results of which processes?

3. Write the type of the following mountains:

   (a) The Black Forest

   (b) The Himalayas

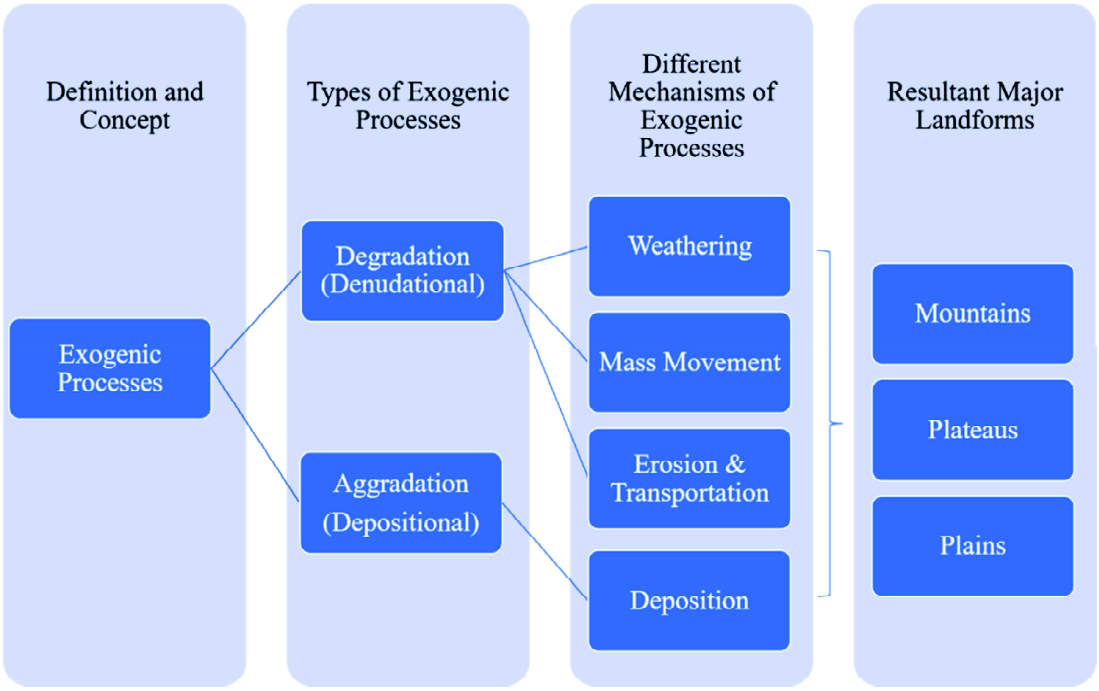
   (c) The Aravalli

   (d) The Fuji Yama

4. Which mountains have surrounded the plateau of Tibet, an intermontane plateau?

5. The Indo Gangetic plain of the Indian sub-continent and the Hwang-Ho Plain of North China are examples of which type of plain?

WHAT YOU HAVE LEARNT



TERMINAL QUESTIONS

1. Define the exogenic processes?
2. Describe the mechanism of erosion, transportation and deposition by various geomorphic agents?
3. Why are plains significant for human beings ?
4. Why are the Mountains called 'Sacred landforms on the Earth'?
5. Distinguish between the following:
   (i) Degradational and Aggradational processes.
   (ii) Intermontane and Continental plateaus.
   (iii) Corrasion and Corrosion.
6. Locate and label the following on the outline map of the world.
   (a) Rockies and Andes Mountains
   (b) Tibetan Plateau

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(c) Himalayas

(d) Indo-Gangetic plain

(e) Mount Fuji Yama

ANSWERS TO INTEXT QUESTIONS

3.1

1. (i) Solar radiation

   (ii) Potential energy arising from the gravitational attraction of the Earth.

2. (i) Weathering

   (ii) Mass Movements

   (iii) Erosion and Transportation.

3. Hydraulic action.

4. Deflation.

5. Glacial drifts.

3.2

1. (i) Mountains

   (ii) Plateau

   (iii) Plains

2. Block mountains are the result of faulting caused by tensile and compressive forces motored by endogenetic forces.

3. (a) Block Mountain

   (b) Folded Mountain

   (c) Relict or Residual Mountain

   (d) Volcanic Mountain

4. Himalaya, Karakoram, Kunlun, Tien Shan.

5. Depositional Plains.