FLUVIAL PROCESSES AND LANDFORMS

Compiled by

PRIYA BERA

The work of running water in the form of surface runoff or overland flow and streams is most important of all the Exogenetic or plantation processes because the running water is the most widespread exogenetic process of this planet earth. The landforms either curved out or built up by running water are called fluvial landforms and the running water which shape them are called fluvial process which include overland flow and stream flow.

Geomorphology deals largely with the action of fluid agents that erode, transport, and deposit mineral and organic matter. The four fluid agents are –

- 1. Running water in surface and underground flow systems
- 2. Waves, acting with currents in oceans and lakes
- 3. Glacial ice, moving Sluggishly in great masses
- 4. Wind, blowing over the ground.

Of the four agents, three are forms of water. Consequently, the science of hydrology is Inseparably interwoven with geomorphology. Geomorphology concerns itself with geologic work that the water in performs on the land.

We have used denudation to mean the total action of all processes by which the exposed rocks of the continents are worn away and the resulting sediments are transported to the sea by the fluid agents. Denudation is thus an overall lowering of the land surface; it tends toward reducing the continents to nearly featureless sea- level surfaces and ultimately, through wave action, to submarine surfaces.

FLUVIAL PROCESSES AND LANDFORMS :-

Landforms shaped by running water are conveniently described as fluvial landforms to distinguish them from landforms made by the other fluid agents – glacial ice, wind and wave. -In terms of area, the fluvial landforms are dominant in the environment of terrestrial life and are the major source areas of human food resources through the practice of agriculture.

Fluvial processes perform the geologic activities of erosion, transportation, and deposition. Consequently, there are two major groups of fluvial landforms: erosional landforms and depositional landforms.

GEOLOGIC WORK OF STREAMS :-

The geologic work of streams consists of three closely interrelated activities:

- 1. Erosion
- 2. Transportation
- 3. Deposition

Stream erosion is the progressive removal of mineral material from the floor and sides of the channel, whether bedrock or regolith.

Stream transportation consists of movement of the eroded particles by dragging along the bed, by suspension in the body of the stream, or in solution.

Stream deposition is the accumulation of transported particles on the streambed and floodplain, or in the floor of a standing body of water into which the stream empties. Erosion, transportation and deposition are simply three phases of a single activity.

Types of Fluvial Erosion :-

The emotional work of the rivers is performed in two ways viz.

- 1. Through chemical erosion
- 2. Through mechanical erosion

Chemical erosion involves corrosion or solution and carbonation while **mechanical erosion** comprises corrasion or abrasion, hydraulic action and attrition. Fluvial erosion is also divided into

- 1. Vertical erosion or Downcutting (which leads to valley deepening)
- 2. Lateral erosion (which causes valley widening).

Processes :-

- 1. Solution or corrosion involves the dissolution of soluble materials through the processes of disintegration and decomposition of carbonate rocks. The soluble materials are removed from the parent rocks and are mixed with the running water of the streams. Most of the salts are removed from the bedrocks thorugh the process of carbonation and are suspended in river water.
- 2. Abrasion or corrasion involves the removal of loosened materials of the rocks of valley walls and valley floors with the help of erosional tools(boulders, cobbles, pebbles etc.). The erosional tools or river loads move down the channel gradient along with water and thus strike against the rocks which come in contact with them. The repetition of this mechanism weakens the rocks which are ultimately loosened and broken down. Thus, abrasion is the mechanism of breakdown of rocks occasioned by erosional tools carried by the rivers.
- **3.** Attrition is the mechanical tear and wear of the erosional tools in themselves. The boulders, cobbles, pebbles etc while moving with water collide against each other and thus are fragmented into smaller and finer pieces in the transit.
- **4. Hydraulic action** involves the breakdown of the rocks of valley sides due to the impact of water currents of channel. In fact, hydraulic action is the mechanical loosening and removal of materials of rocks by water alone.

FLUVIAL LANDFORMS :-

Erosional landforms :-

The significant landforms resulting from fluvial erosion by streams include -

a) river valleys,

- b) canyons,
- c) gorges
- d) waterfalls
- e) potholes

River valleys

The valleys curved out by the rivers are significant erosional landforms. The shape and dimension of fluvially originated valleys change with the advancement of the stages of fluvial cycle of erosion. The valley formed in the youthful stage of fluvial cycle of erosion and in the initial stage of valley development is V- shaped having steep valley side slope of convex element. The valley is very deep and narrow, both the valley sides meet together at the valley floor and thus water always touches the valley sides. Such type of V- shaped valleys are the result of accelerated rate of downcutting.

They are further transformed into very broad and shallow valleys having concave valley side slope of very gentle gradient during old stage, V – shaped valleys are divided into two types –

- Gorges- A very deep and narrow valley is called a gorge. Gorges are formed due to active downcutting of the valleys through the mechanism of pothole drilling during juvenile stage of the fluvial cycle of erosion.
- Canyons Canyons are the extended form of gorges. Canyons represent very deep narrow but long valleys. The grand canyon of the colorado river in the states of Arizona is one of the most important canyons of the world.

Waterfalls

Waterfalls or simply falls are caused because of sudden descents or abrupt breaks in the longitudinal course of the rivers due to a host of factors – variation in topographic reliefs, fall in the sea level, and related rejuvenation, earth movement etc. A waterfall may be defined as a vertical drop of water of enormous volume from a great height in the long profiles of the rivers.

Potholes

The kettle like small depressions in the rocky beds of the river valleys are called potholes which are usually cylindrical in shape. Potholes are generally formed in coarse -grained rocks such as sandstones and granites. Pothole drilling is the mechanism through which the grinding tools when caught in the water eddies start dancing in circular manner and grind and drill the rockbeds of the valley like drilling machine and thus from small holes which are gradually enlarged by the repetition of the said mechanism.

Structural benches

The step like flat surfaces on either side of the present lowest valley floors are called terraces. The benches or terraces formed due to differential erosion of alternate bands of hard and soft rock beds are called structural benches.

River terraces

The narrow flat surfaces on either side of the valley floor are called river terraces which represent the level of former valley floors and the remnants of former flood plains. River terraces are formed due to dissection of fluvial sediments of flood plains deposited along a valley floor.

Rills

Rills are shallow channels eroded by threads of turbulent flow developed in the sheet flow. During rain storms rills erode headward on the steepest local gradient at faster rate. On open slopes they tend to form parallel to one another, converging in hillside hollows to form dendritic patterns. Rills are ephemeral features. They may be destroyed and recreated during major storms. The rills terminate at the base of slopes and thus they are not part of the regional drainage network.

Depositional Landforms

The depositional landforms created by the running water are -

- 1. Floodplain
- 2. Alluvial fans
- 3. Natural levees
- 4. Meanders and oxbow lakes
- 5. Deltas

Floodplain

A floodplain is an area of land adjacent to a stream or a river course. It stretches from the banks of its channel to the base of the enclosing valley walls. This regions normally experiences flooding during periods of high discharge. These are the surfaces of low relief developed on the alluvium adjacent to a stream. The flood plains become the stream bed during flood seasons.

Meanders

Meandering channels form where streams are flowing over a relatively flat landscape with a broad floodplain Technically, a stream is said to be meandering when the ratio of actual channel length to the straight line distance between two points on the stream channel is greater than 1.5. Channels in these streams are characteristically U-shaped and actively migrate over the extensive floodplain. Floodplains develop when streams over-top their levees spreading discharge and suspended sediments over the land surface during floods.

Natural levees

Levees are ridges found along the sides of the stream channel composed of sand or gravel. Levees are approximately one half to four times the channel width in diameter. Floodplain deposits can raise the elevation of the stream bed. This process is called aggradation.

Oxbow lakes

Oxbow lakes are the abandoned channels created when meanders are cut off from the rest of the channel because of lateral stream erosion.

Alluvial fans

An alluvial fan is a large fan-shaped deposit of sediment on which a braided stream flows over. Alluvial fans develop when streams carrying a heavy load reduce their velocity as they emerge from mountainous terrain to a nearly horizontal plain. The fan is created as braided streams shift across the surface of this feature depositing sediment and adjusting their course.

Deltas

Streams flowing into standing water normally create a delta. A delta is body of sediment that contains numerous horizontal and vertical layers. Deltas are created when the sediment load carried by a stream is deposited because of a sudden reduction in stream velocity. The surface of most deltas is marked by small shifting channels that carry water and sediments away from the main river channel. These small channels also act to distribute the stream's sediment load over the surface of the delta. Many deltas are triangular in shape.