

Geological Work of River

(Part-3)

6. **Wadies**- These are channels or gullies formed during rain in arid regions (desert) hence, they remain dry except during the rainy season.

7. **Gulleys/Rills**- Gully is a water-worn channel, which is particularly common in semi-arid areas. It is formed when water from overland flows down a slope during heavy rainfall and is concentrated into rills (small channels), which merge and enlarge into a gully.

8. **Badlands**- Badlands are dramatic landforms characterized by a network of deep, narrow and winding gullies, along with occasional hoodoo rocks*. Their steep, barren slopes provide striking evidence of the force of erosion by water and wind. Badlands form where weak, relatively unconsolidated (loose) sedimentary rocks (such as shale, siltstone and poorly cemented sandstones) are exposed to vigorous fluvial erosion. They tend to occur in arid or semi-arid regions, where rain often falls in short, torrential thunderstorms.

Facts To Know

***Hoodoo rocks**- Hoodoo rocks are often fantastically shaped, naturally carved rocks or earth pedestals, pillars or columns.

9. **River Valley**- The river originates in the highlands and comprises of large amount of fresh water flowing continuously in a long line across the land. As the water flows down, it cuts its way along its course thus forming a valley. A **valley** is a low stretch of land between hills, especially one that has a river flowing through it. River valley is formed by three processes-

i) **Valley deepening**- The process of down-cutting of the valley floor that takes place in the upper part of the river course is called as valley deepening. Due to this process narrow, deep and steep-sided valley features called as gorges and canyons are formed.

Canyons and Gorges- **Canyon**, deep, steep-walled, V-shaped valley cut by a river through resistant rock. Such valleys often occur in the upper courses of rivers, where the stream has a strong, swift current that digs the valley relatively rapidly. Smaller valleys of similar appearance are called **gorges**. Canyons and gorges are thus formed in the initial phase of valley development.

Facts To Know

Ravines- They are small narrow steep-sided valley that is larger than a gully and smaller than a canyon and that is usually worn by running water.

The process of down-cutting by river water is not an everlasting process. As the **base-level of erosion** is reached at the later stage of river valley development, the down-cutting action by river decreases and finally stops. This happens when the river completes its course i.e it meets with the sea, whereby it loses its erosive power.

Facts To Know

What is base level?

A stream of water stops flowing when it reaches the lowest level which is called as base level. In hydrology and geomorphology, the term base level is the limit below which flow of water cannot erode. In other words, the stream of water cannot cut deeper than its base level; therefore, its energy goes into cutting its banks sideways (or valley widening takes place). As a result, the stream meanders, gradually widening its valley.

For example- If river drained its water to the sea, then its base level of erosion is the sea level. Or if the river enters a lake, then the level of water in the lake acts as the base level of erosion.

ii) **Valley widening** – As the river flows in low-relief areas down its course from the highlands, the down-cutting power decreases due to gradual lowering of channel gradient and hence the river starts cutting the valley sides with wide swinging curves and meanders. It is also called as **lateral erosion** (the erosion of the walls of valley by the stream which leads to valley widening).

iii) **Valley lengthening**- The river advances along its course downhill by the process of headward erosion (or regressive erosion), by which the long profile of the river is developed from the base-level of erosion to its source.

Headward erosion is defined as the erosion at the origin of a stream channel, which causes the origin to move back away from the direction of the stream flow, and so causes the stream channel to lengthen. Apart from the process of headward erosion by which valley lengthening takes place, the other processes involved in valley lengthening are-

- a) increase in the size of meanders;
- b) land upliftment by tectonic activities that results in extension of the valley through the newly exposed lands.

Shapes of the river-valley developed by river at its different stages-

At different stages of the erosional cycle, the valley acquires different profiles-

- **V' shaped valley**- At a young stage (i.e in the upper part of river course), the valley is deep, narrow with steep wall-like sides and a convex slope. The erosional action here is characterized by predominantly **vertical downcutting** nature. The profile of valley here is typically 'V' shaped (called as gorges).
- **U-shaped valley**- At the matured stage (i.e the river flows in low-relief areas where valley widening predominates), the **lateral erosion** (erosion of the sides of valley) becomes prominent and the valley floor flattens out (attains a 'V' to 'U' shape). The valley profile now becomes typically 'U' shaped with a broad base and a concave slope.

10. River Terraces- River terraces are erosional features characterized by stepped benches along the river course in a flood plain. Terraces represent the surfaces marking old valley floor or floodplain levels. They may be bedrock surfaces without any alluvial cover or alluvial terraces consisting of stream deposits.

The terraces may result due to the following causes-

- a) Change in hydrological regime due to climatic changes.
- b) Sea level changes in case of rivers closer to the sea.
- c) Receding water after a peak flow.
- d) Tectonic uplift of land.

Formation of river terraces due to rejuvenation phenomenon- In the absence of tectonic disturbances, the river attains a profile of equilibrium along its course downhill and there will be formation of depositional features in the river plains. But if there occur a subsequent tectonic upliftment of the source region, it results in the gradient of the river to increase thus resulting in the increased velocity of river water. This will again initiate the down-cutting process of the valley floor thus giving rise to the development of topographic features characteristic of young stage of river. This phenomenon of the development of youthful topographic features in a landmass having stable features is known as **Rejuvenation**.

Due to upliftment of the source region, erosive action by river becomes more active and the river cuts through its old flood-plain, resulting in the formation of a new valley beneath the former (older) valley floor. Thus the floor of the oldest valley is left as a pair of river-terraces. As this process of upliftment of source region takes place repeatedly, there occurs a stepped-terrace like topography where the higher terraces are separated by steep-wall like escarpments from those lying beneath them. Thus the highest terrace above the floodplain will accordingly be the oldest while the lowest terrace will be the youngest. The number of terraces also reflects the number of periods of rejuvenation which has affected the river valley.

Types of river terraces are namely-

- (i). **Paired terraces:** The river terraces may occur at a similar elevation on either side of the rivers.
- (ii). **Unpaired terraces:** When a terrace is present only on one side of the stream and with none on the other side or one at quite a different elevation on the other side.

12. Incised or Entrenched Meanders- These are erosional landforms that forms due to rapid upliftment of land. Entrenched meanders are symmetrical and form when the river down cuts quickly. The speed of the river down-cutting gives less opportunity for lateral erosion to occur thus, giving them symmetrical slopes. These are very deep and wide meanders that can also be found cut into hard rocks. However, it is common to find meandering courses over floodplains and delta plains where stream gradients are very gentle.