

**M.A/M.Sc. Geography Part-I
Paper-II- Geomorphology
Topic- Normal Cycle of Erosion**



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NORMAL CYCLE OF EROSION

- The cycle of erosion by fluvial processes (running waters or rivers) is called normal cycle of erosion.
- The normal cycle of erosion begins with the upliftment of any landmass with reference to sea level.
- As the land rises, the rivers are originated and their erosional work starts.
- The rate of uplift in the beginning far exceeds the rate of erosion.
- After some time upliftment of the land stops and erosion becomes more active. The land area, tectonically, remains stable .



NORMAL CYCLE OF EROSION

- There is progressive development of river valleys in sequential order and the whole land area progressively passes through three successive stages of youth, mature and old and is ultimately transformed into low featureless plain of undulating surface.
- Thus, the penultimate end product of normal cycle of erosion is called peneplain which is characterized by undulating surface with residual convexo-concave low hills known as 'monanocks', 'unakas' and 'mosores'.



YOUTHFUL STAGE

- **i. Youthful Stage:**
- In the beginning, the streams are less in number and short in length.
- The slopes are dominated by numerous rills and gullies rather than big streams.
- These rills and gullies lengthen their longitudinal profiles (increase their lengths) through head ward erosion.
- Gradually and gradually the main streams deepen their valleys.



YOUTHFUL STAGE

- The rivers are continuously engaged in rapid rate of down-cutting of their valleys (valley incision) because the transporting capacity of the rivers is maximum due to high velocity of flow rate and kinetic energy because of very steep channel gradient.
- High transporting capacity enables the rivers to carry big boulders (tools of erosion) of fairly good size (large size) and high calibre (angular boulders) which help in the pothole drilling of the river beds.
- It may be mentioned that pothole drilling is the most active and powerful process of vertical erosion (valley deepening) in the juvenile stage of the normal cycle of erosion.



YOUTHFUL STAGE

- The valley becomes very narrow and deep with almost vertical side walls due to continuous active down cutting of the valley floors at exceedingly fast rate.
- The valley side slopes are convex in plan. Thus, the resultant juvenile valleys are V-shaped and are called gorges and canyons.
- The valley floors are stud-ded with numerous pot holes which are the result of pothole drilling.



YOUTHFUL STAGE

- River capture is the most characteristic feature of the juvenile stage of the normal cycle of erosion.
- Main rivers having steeper channel gradients and more volume of water capture smaller streams of relatively low channel gradient through headword ero-sion.




MATURE STAGE

- **i. Mature Stage:**
- Marked valley deepening through vertical erosion during youthful stage results in pronounced decrease in channel gradient and consequent decrease in flow velocity with the result the arrival of early maturity is heralded by marked decrease in valley deepening due to (i) decrease in channel gradient, (ii) decrease in the velocity of river flow, (iii) decrease in the transporting capacity etc.
- Consequently, valley widening through active lateral erosion dominates over valley incision through downcutting. The convex slope of valley sides is progressively transformed into uniform or rectilinear slope and the gorges and canyons characterized by deep and narrow valleys are replaced by broad and flat valleys.



MATURE STAGE

- The rivers deposit big boulders at the foothill zones due to sudden decrease in channel gradient and hence marked decrease in the transporting capacity of the rivers.
 - These materials form alluvial fans and alluvial cones. The gradual expansion of these fans and cones due to their continuous growth result in the formation of extensive peidmont plains through the coalescence of several fans and cones.
 - Interstream areas or water divides are continuously narrowed due to backwasting caused by active lateral erosion and valley widening.
 - Interstream areas are trans-formed into narrow ridges. The major river erodes down to its base level (sea level) and becomes 'graded'.
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MATURE STAGE

- The longitudinal profile of the master river becomes the profile of equilibrium wherein there is balance between available energy and the work to be done i.e., balance between the transport-ing capacity and total sediment load to be transported.
- Mrked decrease in channel gradient rivers adopt sinuous courses and develop numerous meanders and loops in their courses.
- Extensive flood plains are formed due to sedimentation of alluvia.
- Rivers frequently change their courses because of gentle to level slopes of the flood plains.
- Numerous ox bow lakes are formed due to straightening of highly meandering loops.
- Deposition of sediments on either side of the river valleys leads to the formation of natural levees

OLD STAGE

- **iii. Old Stage:**
- The old stage is characterized by further decrease in channel gradient, almost total absence of valley deepening, decrease in the number of tributary streams and flattening of valleys.
- Tributary streams also attain the base level of erosion and are graded.
- Lateral erosion and consequent back wasting eliminates most of inter stream areas.
- Valleys become broad and flat characterized by concave slopes of valley sides.
- Down cutting of the valleys is totally absent.
- Weathering processes are most active.
- Lateral erosion, down wasting and weathering continuously degrade the land resulting into gradual lowering of absolute altitude and water divides.

OLD STAGE

- Inter stream areas and water divides are remarkably reduced in height and are changed to lowland but they still rise above the surrounding areas.
- Transporting capacity of the rivers becomes minimum because of very low channel gradient and thus the rivers become overloaded.
- Consequently, sedimentation becomes most active during this stage.
- The rivers adopt highly meandering courses.
- The extensive flood plains with level to gentle slopes (2° - 5°) and very low channel gradient make the river flow so sluggish that the main channel of the river is divided into numerous distributaries and thus the river becomes braided.
- Valley sides are bordered by extensive natural levees which are also known as bluffs which denote the farthest limit of recurrent floods of the concerned rivers.
- Rivers deposit and form extensive deltas at their mouths if other environmental conditions remain favourable for delta formation.



OLD STAGE

- The entire landscape is converted into extensive flat plain of undulating surface except a few residual convexo-concave hills which project above the general flat surface and thus break the monotony of relief less flat plain, called as pene plain. These residual hills, the result of differential erosion, are called monadnocks.
- This ideal normal cycle of erosion can pass through its all the three stages (i.e., youth, mature and old) and the peneplain can be formed only when the region remains in stand still position for longer duration of crustal stability but the availability of such condition is of remote possibility because the earth is very much unstable.
- The plate tectonics have also revealed that plates are always mobile and hence long period of crustal stability is not possible.
- Thus, the smooth functioning and completion of normal cycle of erosion is very often disturbed due to tectonic events and also due to climatic changes.

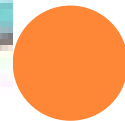


INTERRUPTION OF NORMAL CYCLE OF EROSION

- The disturbance in the cycle of erosion is called interruption of normal cycle of erosion which is caused by changes in sea level (either due to upliftment or subsidence of oceanic bottoms or due to glaciations and de-glaciations during great ice ages, like Carboniferous glaciations of the Gondwanaland during Carboniferous period and Pleistocene glaciations of the northern hemisphere during Pleistocene period), upliftment or subsidence of land areas, volcanic eruptions and climatic changes.
- The interruption of normal cycle of erosion by volcanic eruptions or climatic changes is called 'accident'.
- The interruptions caused by negative changes in base level (lowering of base level-maximum limit of vertical erosion by rivers) due to fall in sea level (because of the subsidence of the oceanic floors) and upliftment of landmass are called rejuvenation, which means renewed vigour of erosive capacity of the rivers.



Three Stages of a River



Thank You

