
CONCEPTS OF GEOMORPHIC CYCLE

Geomorphology is the study of the earth's landforms. William Morris Davis founded this subfield of geography. Though at his time, the traditional idea of the development of landforms was through the great biblical flood, Davis and others began to believe that other factors were responsible for shaping the Earth. Davis developed a theory of landform creation and erosion, which he called the "geographical cycle."

THE GEOGRAPHIC CYCLE

Beginning in 1899, Davis proposed that denudation of the land occurs in what he called "the geographical cycle." According to Davis, this cycle is initiated by an uplift of an area above sea level, followed by a wearing down of the surface through the action of running water and gravity until either the region is worn away (base levelled) or the events are interrupted by renewed uplift.

It was further explained that such a cycle of erosion occurs under conditions of a rain-and-rivers environment (humid climate), which were assumed to reflect the normal climate for the Earth. In all cases, erosive power was presumed to be controlled primarily by slope; hence, the cyclic system was slowed down as the land was levelled and relief and elevation were diminished. The end point of a low-inclination landform was termed a peneplain, and it was said to be locally surmounted by erosionally-resistant highs called monadnocks. The peneplain as a whole was presumed to be graded to regional base level (in all likelihood mean sea level) by denudational agencies (e.g., running water).

BRIEF FACTS

The word erosion comes from the Latin word "erosionem" which means "a gnawing away."

EXPLANATION OF THE CONCEPT

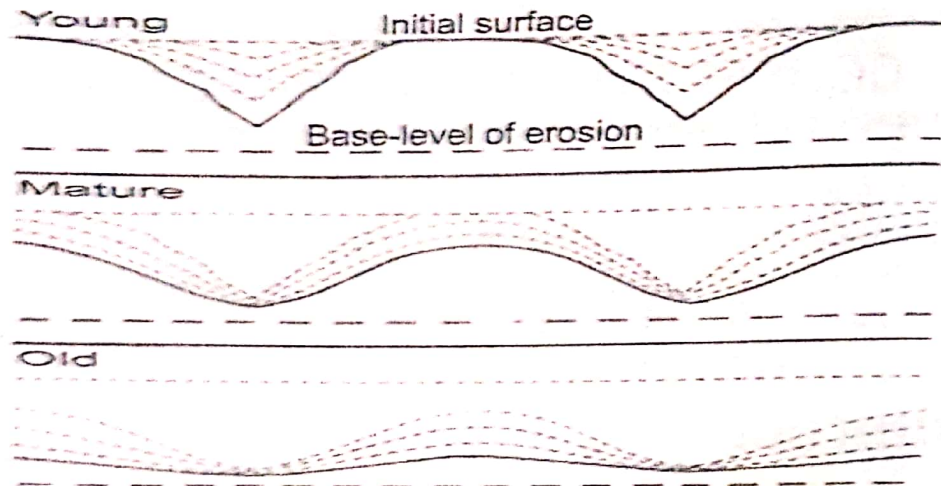
In a normal cycle three stages have been recognized as: youth stage, mature stage and old stage. These follow each other in a regular sequence:

Youth Stage

In this stage, the river flows along an uneven surface and there is intensive bottom erosion, the gradients are steep and the erosion is rapid. The rapid deepening of the channel leads to the formation of V-shaped valleys. Thus, during the youth stage of a river, the valley form undergoes vigorous development, particularly in depth and headward growth. Lakes, rapids, waterfalls, steep-sided valleys and gorges are of common occurrence during this stage.

Besides, the phenomenon of river-capture or river piracy takes place in this stage. River Capture happens when two rivers flowing in opposite directions from a single divide. Gradually deepening, of the valley continues headward with pronounced dissection of the ridge. Sometimes

this headward migration of one river enables it to reach the river on the other side. But, as the first river has a steeper gradient than the other one, the course of the second river gets diverted and its water starts draining through the channel of the first river. This process of diversion of a river by the headward migration of another river with steeper slope is known as River-Capture or River-Piracy.



Mature Stage

In this stage, river flows with a graded profile i.e. attains a profile of equilibrium. The land mass is fully dissected and a well-integrated drainage system is developed. Ridges and valleys develop prominently. Flood plains develop and river meandering takes place. The topography consists of features such as: mesa, butte, meanders, oxbow lakes, natural bridge, flood plains, alluvial fans etc.

Old Stage

In this stage, the gradients are gentle and the velocity is low. Accordingly the river loses most of its erosive power and flow in a sluggish manner. In old age, a river has maximum meandering. The river at this age does little of erosion and transportation but is mostly engaged in deposition. This stage is characterised by the development of distributaries and the river flows almost at the base level of erosion. By this time, most of the streams have low gradients and extensive flood plains. The ultimate goal which would be reached is the reduction of the land to a surface coinciding with sea level projected in land. This imaginary surface is called "base-level" and is attainable only in theory.

The land surface produced at old stage in cycle of erosion is called as "Peneplain". A peneplain is not perfectly flat but has gentle slopes. Because the streams are sluggish (slow) and the land slopes are low, further erosion is very slow. The topography consists of features like peneplains, natural levees, deltas, etc.

Most of the cycles of erosion do not reach the final stage, as sometimes during their operation either climatic or tectonic disturbances take place, and thus results in an incomplete or partial cycle.

It is not easy to set a figure for the number of years required for a region to pass from initial stage to old stage, because it depends upon how high the landmasses are elevated and how resistant the rocks are to weathering and erosion. Perhaps it would be safe to say that in known cases of geologic records, several million years have been required to reduce a mountain mass to

a peneplain. Sometimes, the region which is progressing through cycle of erosion contains patches or zones of rocks which are more resistant to weathering or erosion. As the cycle progresses from maturity to old stage, these harder rocks are left standing as prominent hills or isolated mountains, which rise above the surrounding peneplains. These isolated hard rocks are called monadnocks.

When this linear course of landscape evolution is interrupted due to uplift, change in sea level, or climate change, the erosive power of the rivers may increase again, and they begin down cutting through their previously deposited floodplain deposits. In a fashion, the landscape reverts to an earlier stage in its evolution (e.g. from intermediate/mature to the initial/young stage), and thus the process has been termed **rejuvenation**.

CRITICISM

An erosion cycle takes so long that no one has ever seen a complete cycle. Geologists try to piece together the parts of the cycle by examining different regions in the modern world and by looking at the geologic record which is spread over several million years. The idealized erosion cycle is based on the presumption that nothing interrupts the regime of erosion. Actually, many interruptions can take place. Once formed, a peneplain is usually elevated again by crustal movement. Sometimes this uplift of land occurs concurrently as cycle progresses. The uplift has taken place either in youthful or during maturity. The landscape and the particular stage is modified to a very great extent.

The cycle of erosion may be modified by the factors of climate. The modification by temperature and rainfall is most dominant in humid tropics and temperate climates.

Further, Davisian erosion cycle theory is hurt by three factors in particular:

1. the presently understood need for continuous isostatic uplift during erosion,
2. the climatic variability displayed by most lands, and
3. the hydraulic behaviour of rivers noted by Gilbert that precludes valley alluviation under normal humid conditions and limits base-level influences over interior slopes.

Though Davis' theory is not entirely accurate, it was quite revolutionary and outstanding at its time and helped to modernize physical geography and create the field of geomorphology. The real world is not quite as orderly as Davis' cycles and certainly erosion occurs during the uplift process. However, Davis' message was communicated quite well to other scientists through the excellent sketches and illustrations that were included in Davis' publications.

EXPECTED QUESTIONS

1. Describe the relief features evolved on Domed and Folded Terrain through fluvial cycle of erosion.
2. What do you understand by cycle of erosion? On what grounds the concept of cycle of erosion is criticized by some geo-morphologists is an over simplification?
3. Describe and discuss normal cycle of erosion?
4. Critically examine the concept of cycle of erosion?
5. Explain the concept of fluvial cycle and the sequential development of landforms.
6. Provide a brief account of fluvial cycle of erosion.