

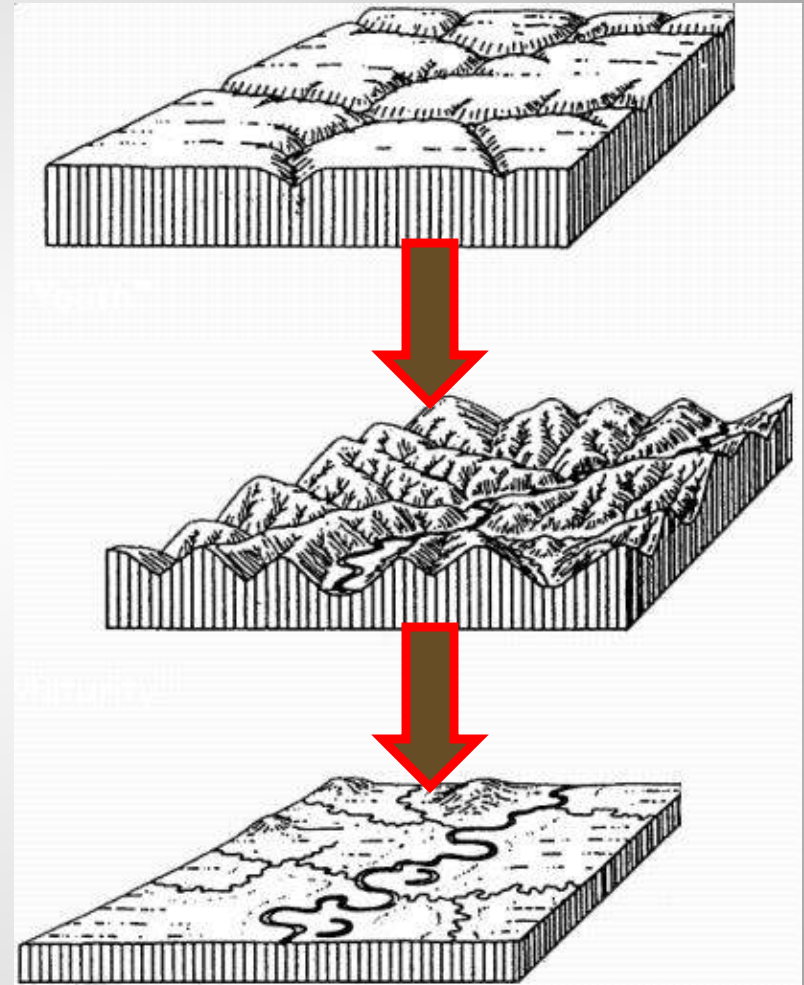
**NORMAL CYCLE OF EROSION
OR GEOGRAPHICAL CYCLE
OF EROSION BY *W. M. DAVIS***

Ranajit Ghosh

William Morris Davis an American geomorphologist, who presented his theory of landform development '**Geographical Cycle of Erosion**' in 1899 by impressing Charles Darwin's '**Origin of The Species**' which was published in 1859. Davis expressed the opinion that "**Landforms evolve like the organic life.**" According to him as organic life passes through the stages of youth, maturity and old, similarly geomorphic landforms also passes from youth through maturity to old stage.

FUNDAMENTAL CONCEPT

- According to W.M. Davis *‘geographical cycle is the period of time during which an uplifted landmass undergoes into transformation by the process of land sculpture and ending into a low featureless plain – a Peneplane.’*



Why is it designated as 'Normal Cycle of Erosion'

- The cycle of erosion by the commonly found, widely available fluvial process or running water is called **normal cycle of erosion**.
- It is normal because fluvial processes cover most part of the globe except cold and hot deserts.

ACCORDING TO DAVIS

“**LANDFORM** IS A FUNCTION OF –

- **STRUCTURE (s)**
- **PROCESS (p) AND**
- **STAGE (t)”**

$$L = f(s, p, t)$$

STRUCTURE

- **Denotes** nature of rocks, arrangement of rocks, rock characteristics, alignment of rocks, resistivity of rocks etc.

PROCESS

- **Denotes** Exogenetic and Endogenetic Processes.

STAGE

- **Denotes** the successive phases of landform evolution. i.e. Youth, Mature and Old.

UNDERLYING PRINCIPLE OF DAVISIAN CYCLE

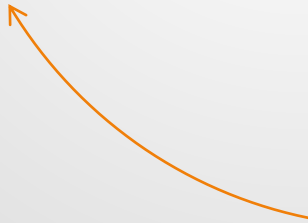
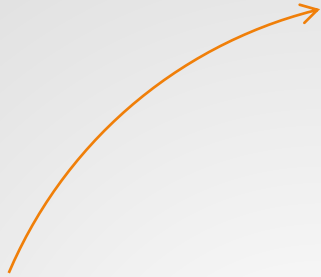
- **BASE LEVEL OF EROSION**— A LEVEL BELOW WHICH STREAMS CANNOT ERODE THEIR VALLEY FLOORS.
- A CRITICAL MINIMUM GRADIENT BELOW WHICH A STREAM CANNOT BE REDUCED
- SLOPE GENTLY UPWARDS AWAY FROM THE COAST
- DAVIS SUPPLEMENTED THE IDEA OF BASE LEVEL WITH THE CONCEPT OF ‘**GRADE**’— THE BALANCE BETWEEN **EROSION** AND **DEPOSITION**
- **GRADATION**= **AGGRADATION** – **DEGRADATION**

CENTRAL CONCEPT

- Transformation of a recently uplifted landmass into a senile gently sloping land through sequence of erosional episode.
- Similarity with concept of ‘**entropy maximization**’ of 2nd law of Thermodynamics.
- Initial Upliftment → **Potential energy = $m \cdot g \cdot h$**
- **COMMENCEMENT OF POTENTIAL ENERGY AND ITS DESTRUCTION THROUGH CYCLICAL PROCESS.**

UPLIFTMENT

Upliftment



Youth



Mature



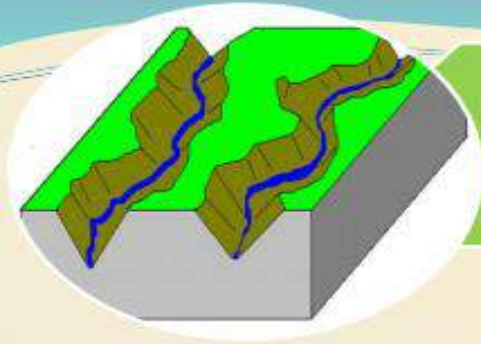
Old

EROSION

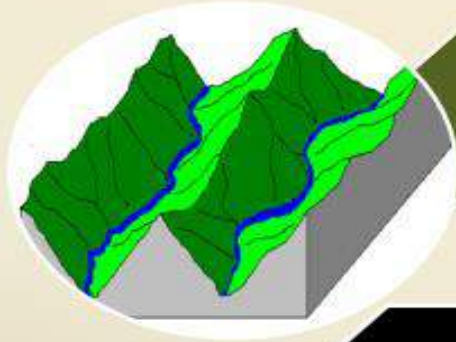
BASIC ASSUMPTIONS

- Landform is the function of endogenetic forces and exogenetic forces.
- Evolution of landforms happened in orderly, sequentially and systematically in different consequent phases of evolution.
- **RAPID UPLIFT & NO EROSION DURING UPLIFT.**
- **COMMENCEMENT OF EROSION AFTER UPLIFTMENT ENDS.**
- **LONG CRUSTAL STABILITY.**

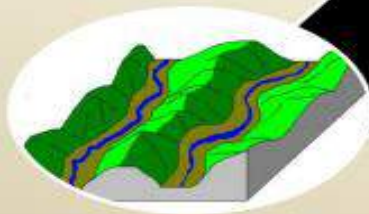
STAGES OF CYCLE OF EROSION



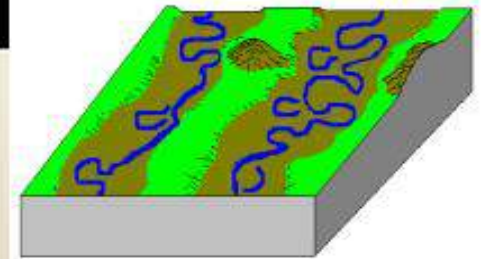
YOUTH



MATURITY



OLD



CHARACTERISTICS OF YOUTH STAGE LANDSCAPE:

- Few Consequent Streams with few Large Tributaries.
- Head ward Erosion by Small Tributaries and Gullies.
- Development of V -shaped Valleys.
- Lack of Floodplain Development.
- Waterfalls and Rapids exist where stream crosses resistant rock beds.
- Maximum Altitude → Maximum Potential Energy.
- Due to steep slope and steep channel gradient rivers are actively involve in vertical erosion → Leads to valley deepening.

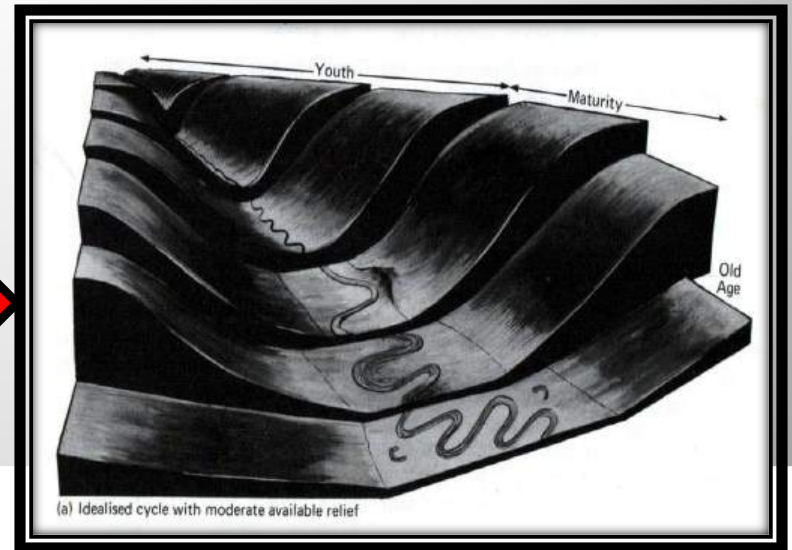
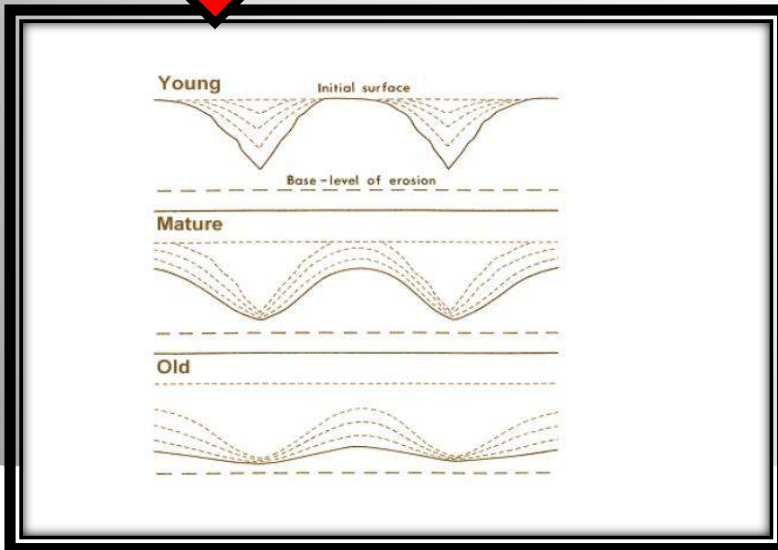
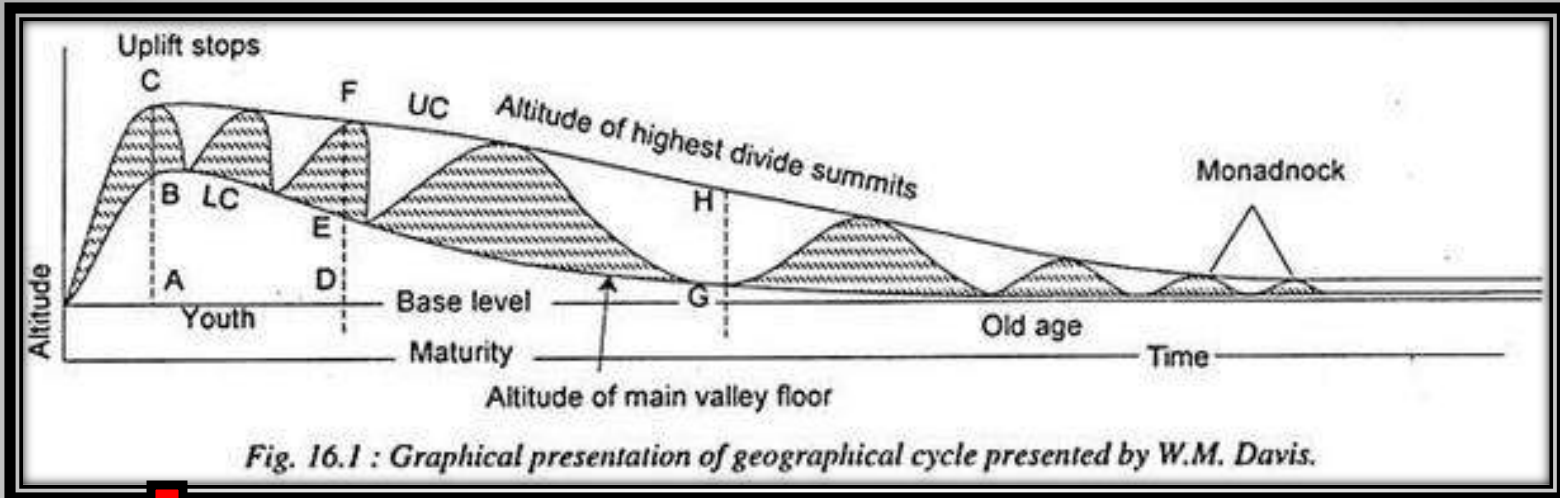
CHARACTERISTICS OF MATURE STAGE LANDSCAPE:

- Stream divides sharp and ridge-like → minimum interstream uplands → Maximum Relief at early Maturity.
- Elimination of lakes and waterfalls.
- Wide Floodplains at Valley floors.
- Topography consists much of Slopes of Hillsides and Valley sides.
- Decrease in channel gradient as well as reduced valley deepening activities.
- Rivers decrease flow velocity as well as carrying capacity.
- Valley widening gets much priority.
- Depth of river valley starts to reduce.

CHARACTERISTICS OF OLD STAGE LANDSCAPE:

- Tributaries – less numerous than in Maturity but more than in Youth.
- Valleys – extremely broad & gently sloping laterally and longitudinally.
- Extensive Floodplains with broadly Meandering Streams.
- Rivers are losses their carrying capacity.
- Stream divides reduce in heights, gently sloping → Residual hills → **MONADNOCKS.**

Graphical Representation of Erosion Cycle



CRITICAL APPRAISAL

Merits

- Provides the dogma, the comprehensive theoretical arrangement of all the aspect of **DENUATION**.
- A Long-term view of Landscape, a geological view.
- Though uplift is intermittent, accelerated, retarded at the end Denudation wins → land is worn down to low relief → peneplain.
- Development of Drainage Basin is well explained.
- Analogy with human geography.
- Realistic Analogy with living being.

Limitations

- Rapid Uplift– not observed.
- Slow period of Erosion can be disrupted by dynamic endogenesis & Climate changes.
- Upliftment and Denudation are divided into separate episodes – which is unrealistic
- Long stability of landmass is not possible.
- Rock structure may not be homogeneous

References

1. An outline of Geomorphology by Wooldridge and Morgan
2. Principles of Geomorphology by W. D. Thornbury
3. The Study of Landforms by R.J . Small
4. Geomorphology by Savindra Singh
5. Geomorphology by Enayet Ahmed

Thank You