

Cycle of Erosion

Propounded by W.M Davis

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INTRODUCTION

- Geomorphology: The study of landforms which is a composite result of different exogenetic activities operated on land surface
- Cycle of erosion: The balance between endogenetic and exogenetic activities in a cyclic process
- Exogenetic forces: (Denudational forces) Forces operating on lithospheric surface and trying to eliminate the differences made by exogenetic forces

➤ Categories of denudational forces

1. Weathering: Process which makes bedrock either weak, fragmented or decomposed just near the earth surface (In-Situ) or to a depth of few metres. Types are Physical and Chemical weathering.

2. Erosion: Process which various erosive agents like running water, wind, glacier, sea waves and underground water obtain and remove rock debris from the earth crust and transport them for a long distance.

CYCLES OF EROSION

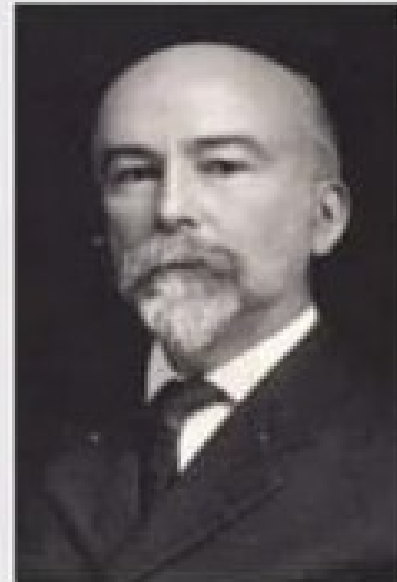
- At first William Moris Davis advanced the idea of “ Geomorphic cycle of erosion”
- He described and explained the distinctive characteristics possessed by the landforms.
- All the landscapes have definite life history after emergence.
- In this way through different stages the elevated land become featureless and flat plain known as Peneplain.

William Morris Davis

Father of American geography



- ☞ He was born in 1850 and died in 1934.
- ☞ He was an American geographer, geologist, geomorphologist and meteorologist,
- ☞ His scientific contribution was the cycle of erosion, which was a model of how rivers create landforms.



➤ According to Davis,

“The geographic cycle is the period of time during which an uplifted landmass undergoes its transformation by the process of land sculpture ending in low featureless plain.”

➤ Philip G. Worcester, accepted the geographic cycle but called it as the “Cycle of erosion”. According to him,

“The cycle of erosion is the time required for streams to reduce newly formed landmass to base level”

➤ Dvais describe the landscape as the function of structure, process and stage

- **Structure:** Means the nature of rock weather it is hard, soft, previous
- **Process:** Determines the type of erosion
- **Stage:** Denotes weather the landmass undergoing its transformation in young stage or in old stage

➤ Davis assumptions,

- Each landscape has definite life history
- As soon as landmass emerged, erosional agents start their work on it.
- Finally formation of ultimate featureless surface

➤ For purpose of demonstrating his cycle, Davis imagined as an initial form a mass of land uplifted from beneath the sea by earth movements

The Stage of Youth

- The upliftment take place very rapidly
- The process of denudation starts on a stable mass
- If there is sufficient rain, a system of streams would quickly develop on the newly emerged surface
- The streams rapidly cut downwards and form deep valleys(“ V” shaped valley)
- Throughout the stage parts of the initial land surface would be preserved

The Stage of Maturity

- Deepening of "V" shaped valley would have been slow down.
- Channels become nearer and nearer to "The base level of erosion".
- Stream velocity would have been reduced.
- Condition of Grade of equilibrium (entire energy is used for the movement of water and its load).
- Vertical erosion slows down and horizontal erosion become dominant
- Gentle meanders, Flood plains



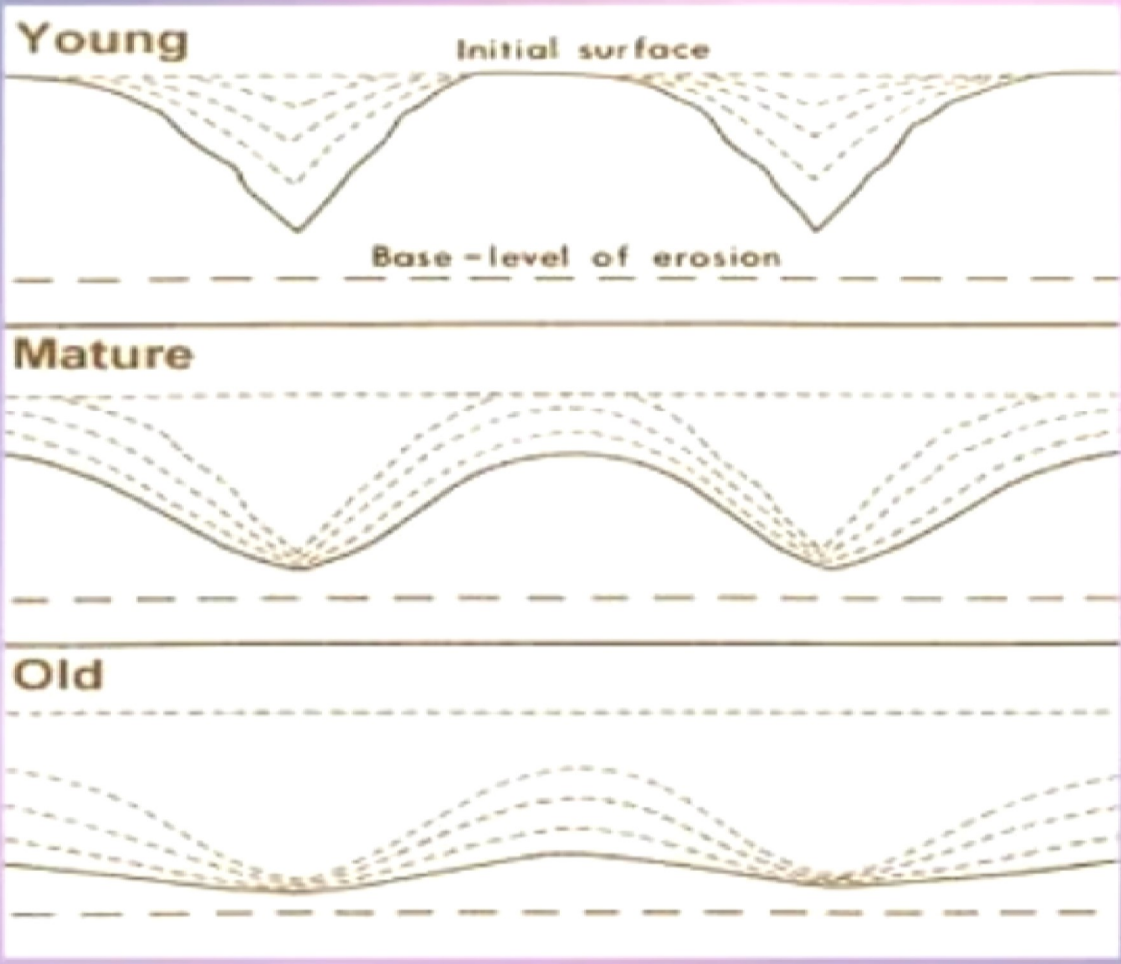
Mature
landscape,
Pennsylvania

The Stage of Old Age

- Landscape evolution become extremely slow in operation.
- Gradual reduction of river gradient, decline of stream energy and continued lowering of angle of valley.
- Continued to broaden their valley by meandering.
- By the end of old stage relief would assume to form very gentle, termed by Davis “Peneplain”
- The remaining isolated hills above the peneplain referred as “Monadnocks”



Meandering: Amazon
river





A Youth

V-shaped valleys, few or no floodplains, extensive interfluvies, many falls and rapids plus some lakes and swamps; incising watercourses



B Maturity

well-drained terrain, all in slopes except floodplains; trunk and some tributary streams meander; maximum relief



C Old Age

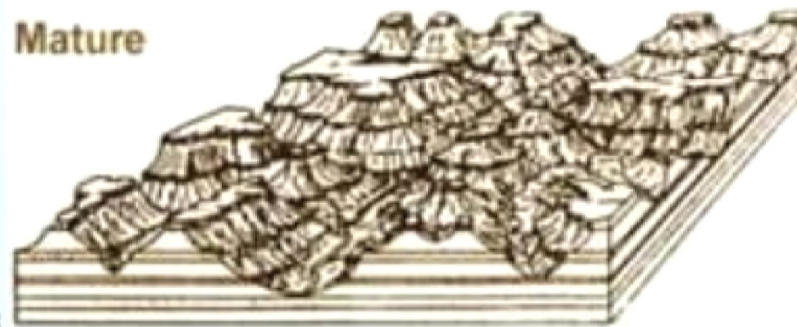
brood, open valleys with widely meandering streams, indistinct divides, erosion remnants of resistant lithologies, surface near erosional base level

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Young



Mature

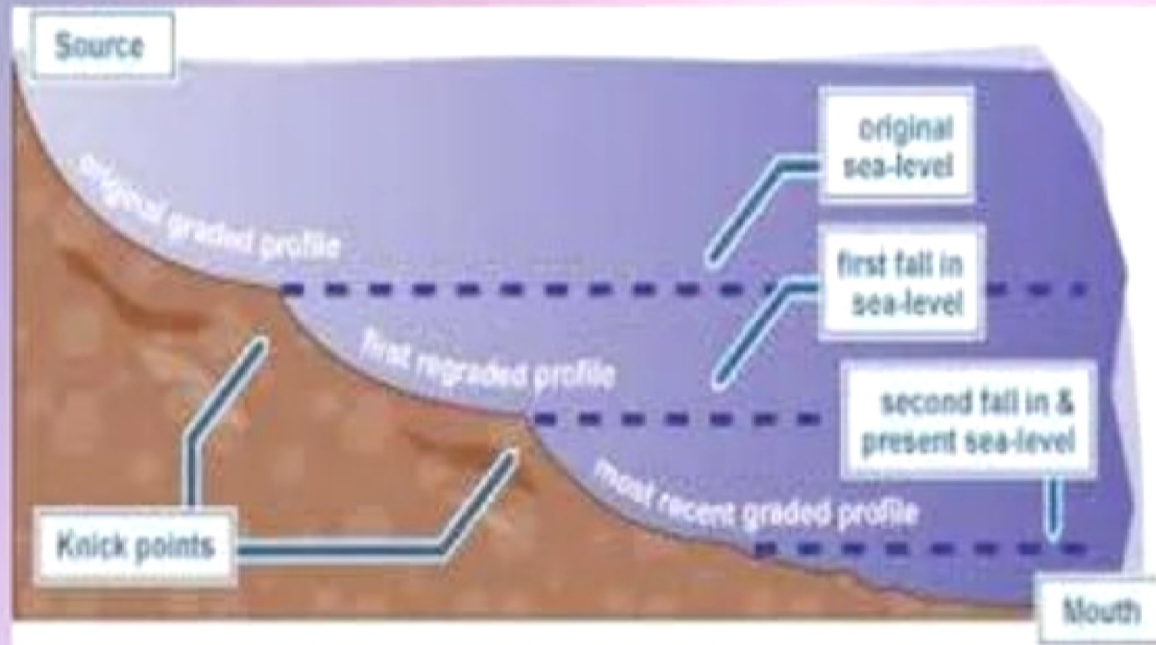


Old

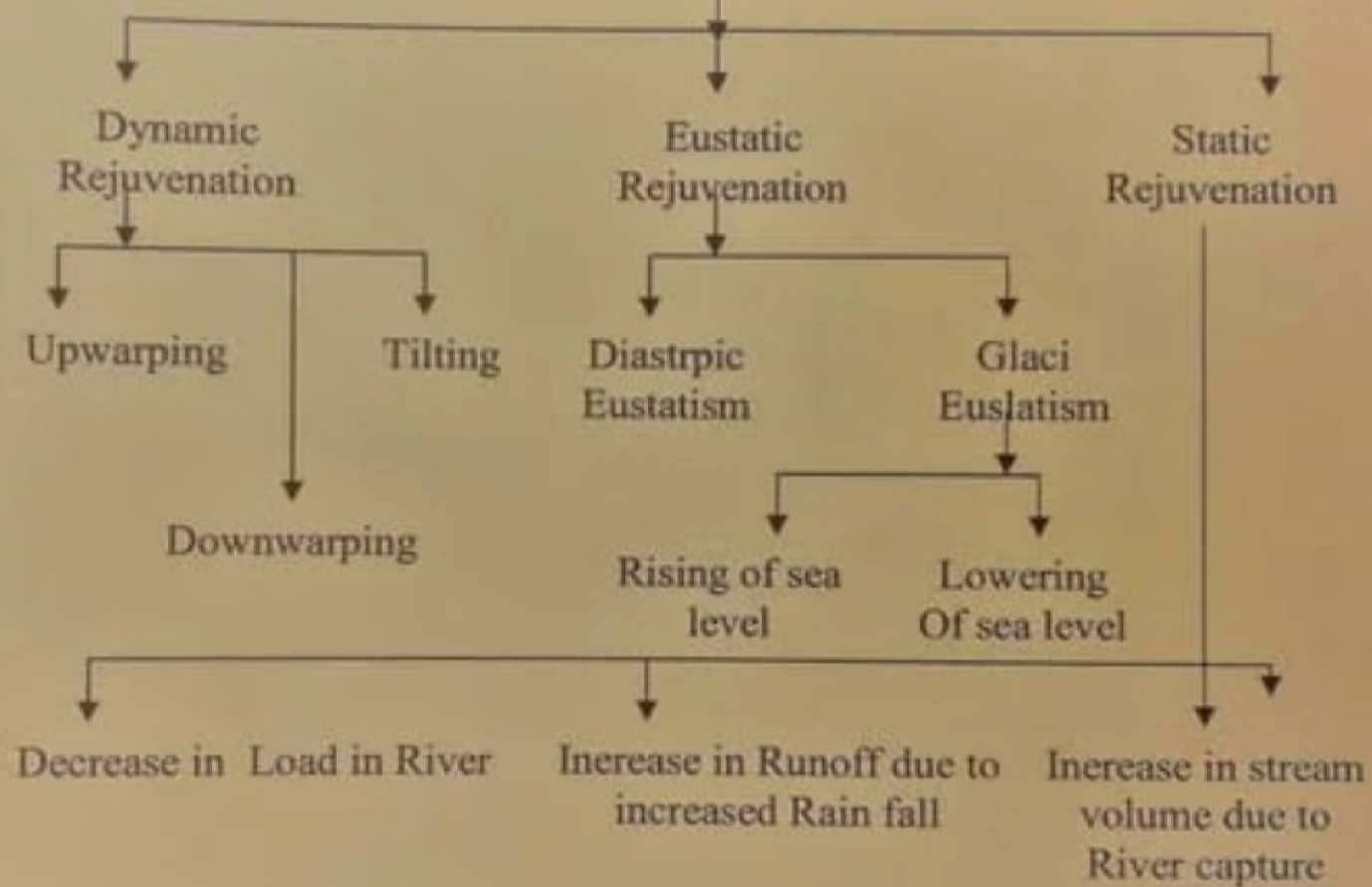


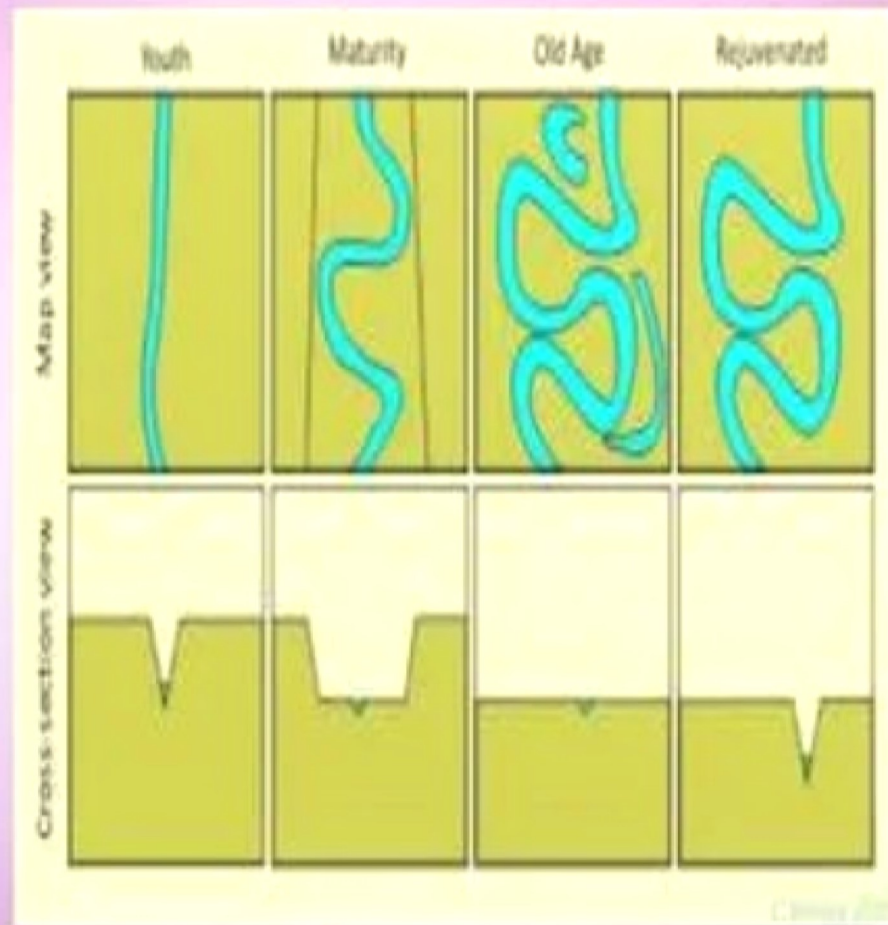
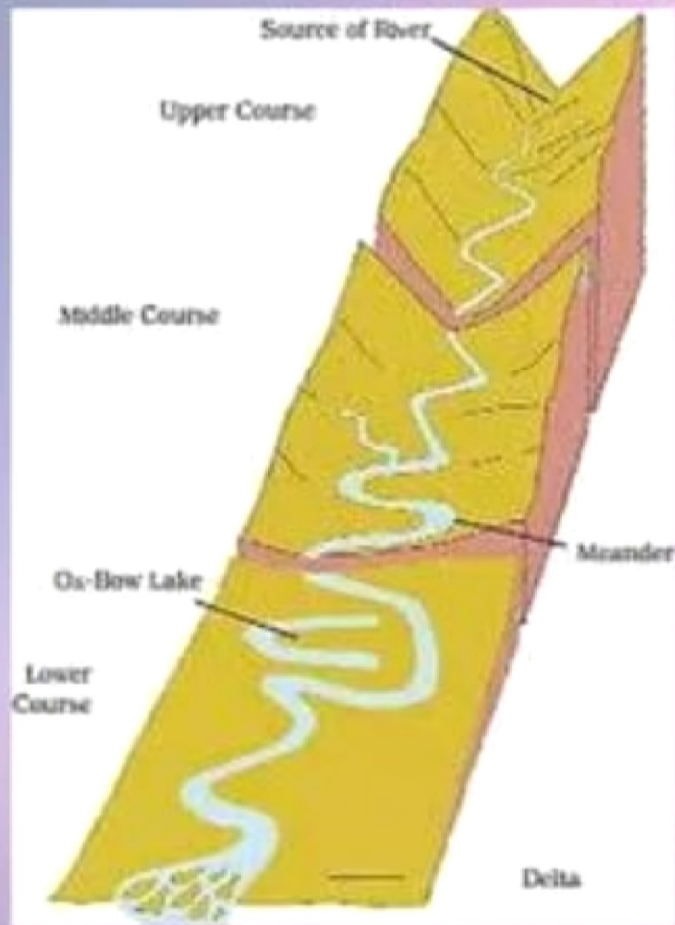
REJUVENATION

- May be caused by epirogenic upliftment of a landmass accompanying tilting and warping.
- World wide lowering of sea-level also causes rejuvenation
- Knick point: The point of intersection of old and new base levels
- Greater the stream speed also causes rejuvenation

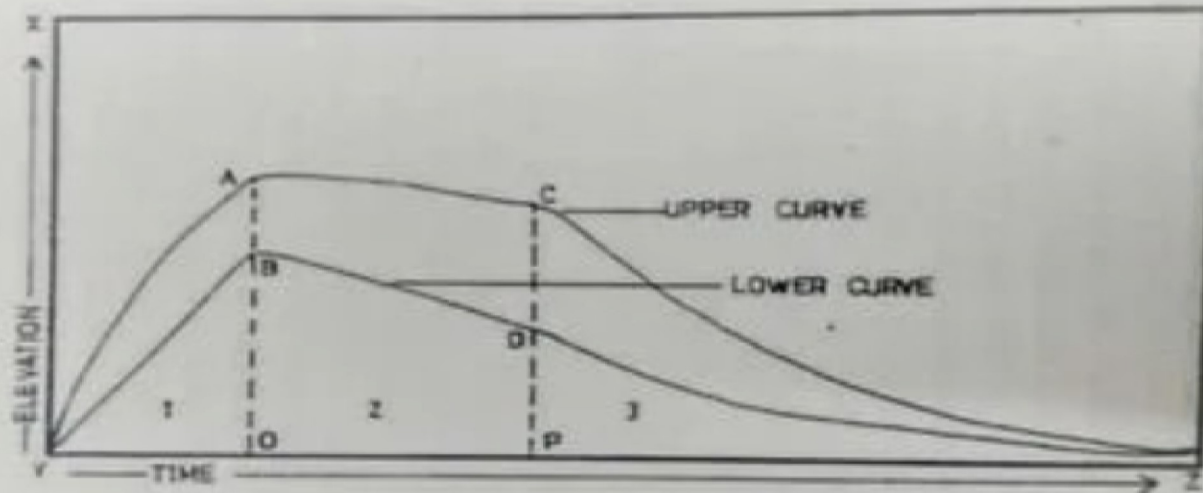


Causes of Rejuvenation





GRAPH OF DAVICIAN CYCLE



Positive aspects of Davis model

- Highly simple and applicable
- Very simple expressive language
- Based on detailed and careful field observations
- Came long time after Hutton's concept.
- Capable of both predictions and historical interpretations

Negative aspects of Davis model

- Rapid rate of upliftment.
- Relationship between upliftment and erosion.
- Long period of crustal stability not possible.
- Dynamic equilibrium concept.
- Based only on observation; no instrumentation and measurement.
- Concept of grade not properly explained.

Thanks



Monadnock