

## 1. Introduction to Geomorphology:

a) Introduction to Physical Geography and its Branches

b) Geomorphology:-

- Definition
- Nature
- Scope

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## Introduction to geography?

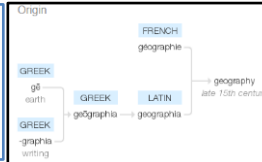
❖ **geography** is the study of the evolving character and organization of the Earth's surface.

❖ It is about **how**, **why**, and **where** human and natural activities occur and how these activities are interconnected.

## Origin of Geography:

**Geography Word Origin:** from French *géographie* or Latin *geographia*,

from Greek *geōgraphia*, from  
24/07/2018 **gē** 'earth' + **-graphia** 'writing'.



Geography  
word used by  
[Eratosthenes](#)  
(276–194 BC)

➤ To get a better understanding of geography,  
two sides need to understand.

### 1. One side: term **regional Geography**:

is concerned with how the Earth's surface is differentiated into unique *places*.

*Ex. Geography of World, India, Maharashtra*

### 2. **Systematic Geography** .

❖ Although places are unique, the physical, economic, and social processes that form them are not.

❖ Thus, geographers are concerned with discovering, understanding, and modelling the processes that differentiate the Earth's surface into places.

➤ This is the other side of geography, which we can term **systematic geography** .

What makes geography  
different from other  
disciplines?

spatial viewpoint

synthesis

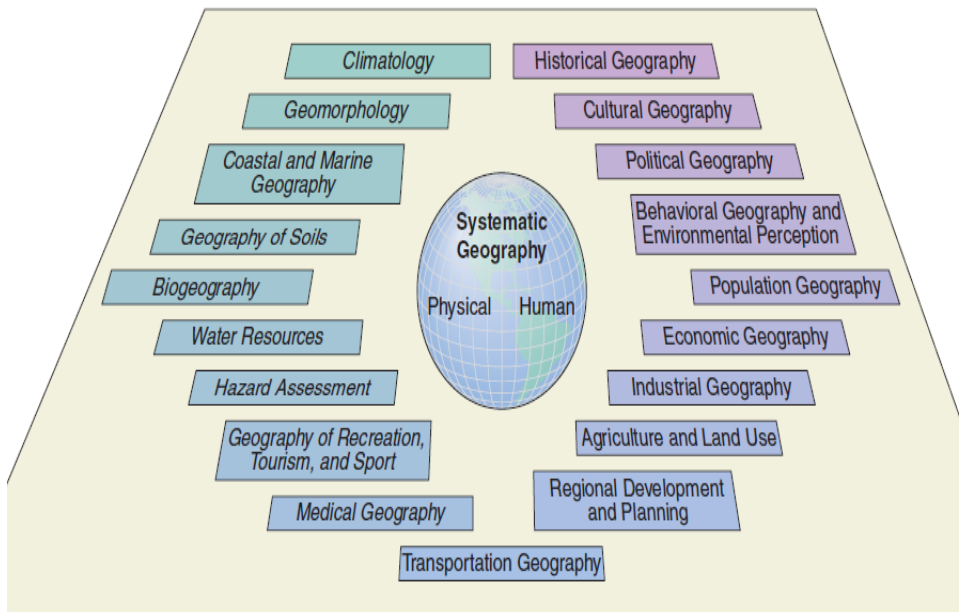
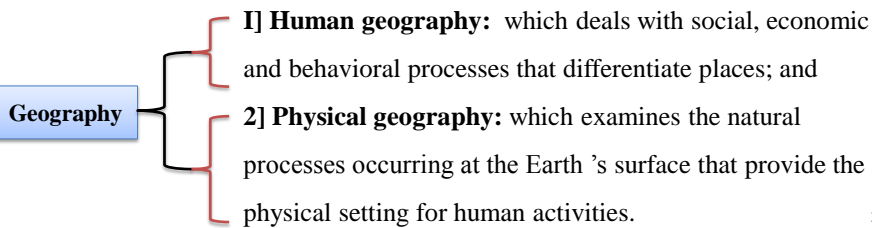
geographic representation

**Definition of Geography:**

*geography defined as... “a unique discipline that focuses on how the natural and human patterns of the Earth’s physical and cultural landscape change and interact in space and time”*

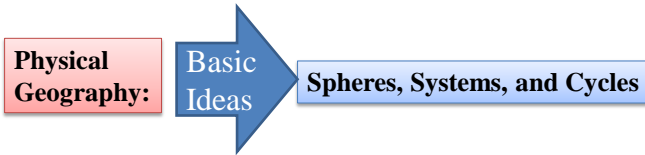
▪ **Field of Geography:**

❖ Geography has a number of subfields, organised in to two broad realms:



**Subfields of systematic geography**

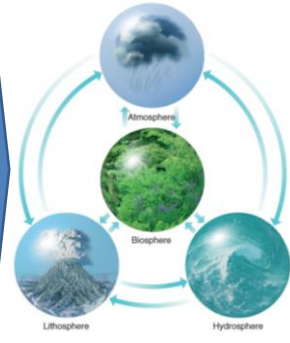
Physical and human geography have many interrelated subfields.



**Definition:** **physical geography** , which examines the natural processes occurring at the Earth 's surface that provide the physical setting for human activities.

**1) spheres:**  
 The natural systems that we study in physical geography operate within the four great **spheres** , of the Earth.

- Atmosphere,
- Lithosphere,
- Hydrosphere,
- Biosphere.



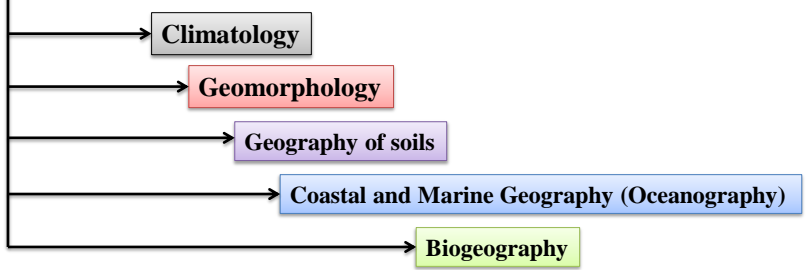
**2) systems :**  
 the processes that shape our landscape.

**3) cycles:**  
 regular changes in systems that reoccur through time.

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**Branches of physical geography**

- Physical Geography as branch of Geography deals with natural environment.
- Five fields of physical geography are known as branches of Physical Geography
- Some are other important sub fields also....



In addition to these five main fields of physical geography, two others are strongly involved with *applications of physical geography*:

- **Water resources**
- **Hazards assessment.**

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### Climatology:

**Climatology studies the transfers of energy and matter between the surface and atmosphere that control weather and climate.**

- is the science that describes and explains the variability in space and time of the heat and moisture states of the Earth 's surface, especially its land surfaces.
- *climate as a description of average weather and its variation at places around the world.*
- Climatology- is also concerned with climate change, past, present, and future
- Climatology- to predict how human activities, such as converting forestland to agricultural use, or releasing CO 2 by burning fossil fuels, will change global climate.



### Geomorphology:

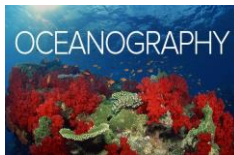
▪ **Includes Study of....**

- is the science of Earth surface processes and landforms.
- The Earth 's surface is constantly being altered under the combined influence of human and natural factors.
- The work of gravity in the collapse and movement of Earth materials,
- the work of flowing water, blowing wind, breaking waves, and moving ice, acts to remove and transport soil and rock and to sculpt a surface that is constantly being renewed through volcanic and tectonic activity.
- **Geomorphology is the study of landform-making processes.**

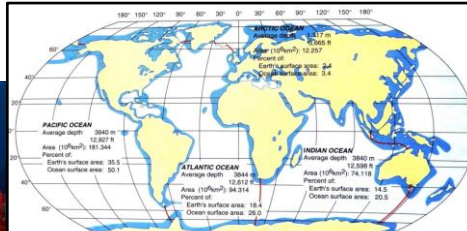


**OCEANOGRAPHY: (COASTAL AND MARINE GEOGRAPHY)**

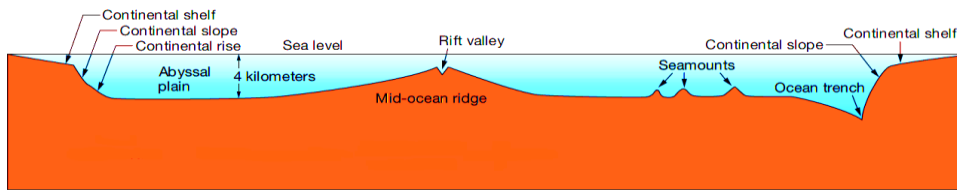
- Oceanography (Coastal and marine geography) examines coastal processes, marine resources, and their human interface.
- The field of **coastal and marine geography** combines the study of geomorphic processes that shape shores and coastlines with their application to coastal development and
- marine resource utilization.
- Marine environment



Passive continental margin

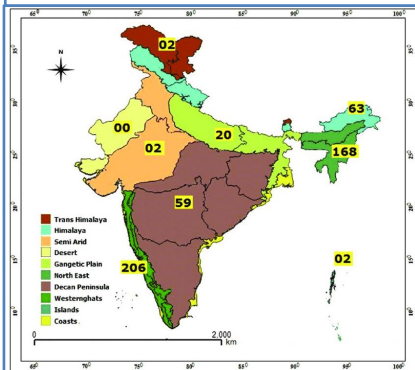


Convergent active continental margin

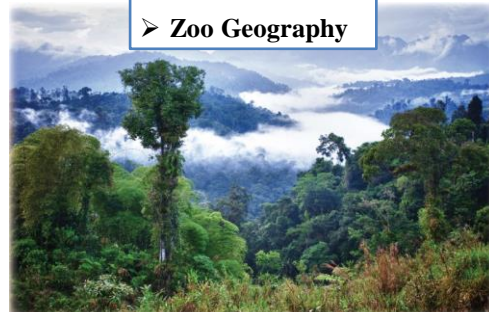


**BIOGEOGRAPHY:**

- ❖ deals with the geographical distribution of plants and animals.
- Biogeography examines the distribution patterns of plants and animals and relates them to environment, migration, evolution, and extinction.
- is the study of the distributions of organisms at varying spatial and temporal scales
- as well as the processes that produce these distribution patterns.
- Local distributions of plants and animals
- biogeography is closely aligned with *ecology*,
- *which is the study of the relationship between organisms and environment*

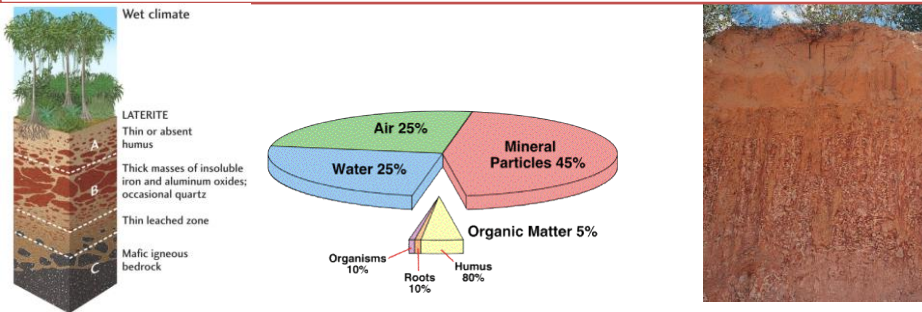


- Plant Geography
- Zoo Geography



## GEOGRAPHY OF SOILS

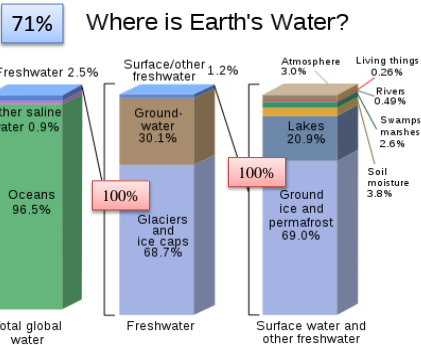
- Soils are influenced by their parent material, climate, biota, and time.
- Geography of soils includes the study of the distribution of...
  - soil types and properties and
  - the processes of soil formation.
- It is related to both geomorphic processes of rock breakup and weathering, and
- to biological processes of growth, activity, and decay of organisms living in the soil



### Water resources :

is a broad field that basic study of the location, distribution, and movement of water,

**Ex.** in river systems or as groundwater, with the utilization and quality of water for human use.



### Hazards assessment:

- is another field that blends (mixture) physical and human geography.



## b. Geomorphology- Definition, Nature and Scope

### □ Introduction:

- Geomorphology is significant branch of Physical Geography.
- The term geomorphology stems from three Greek words...*i.e.*
  - **'ge'**: *meaning earth*
  - **'morphe'**: *meaning form*
  - **'logos'**: *meaning a discourse*

***:Geomorphology there fore, is defined as the science of description (discourse) of various forms of the earth's surface."***

### Definitions:

1) P G Worcester (1940):

“Geomorphology as the interpretative description of the relief features of the earth surface,

Thornbury (1954) included sub-marine forms in addition to surface reliefs in the realm of geomorphology.

A L Bloom (1979): Geomorphology as the systematic description and analysis of landscapes and the process that change them.

- Geomorphology may defined as the scientific study of surface features of the earth's surface involving interpretative description of landforms , their origin and development and nature and mechanism of geomorphological process which evolve the landforms

**Geomorphology** is the scientific study of the origin and evolution of topographic and bathymetric features created by physical, chemical or biological processes operating at or near the Earth's surface

<https://en.wikipedia.org/wiki/Geomorphology>



## Scope of Geomorphology

Subject matter of study in Geomorphology as scope may organized on the basis of...

**A] Dimension and scale of relief features (landforms)**

**B] Process that shape landforms**

**C] The approaches to the geomorphic study**

- Systematic study of landforms requires some fundamental knowledge of geology because development of landforms depend of material of earth's crust and partly on the forces coming from within the earth

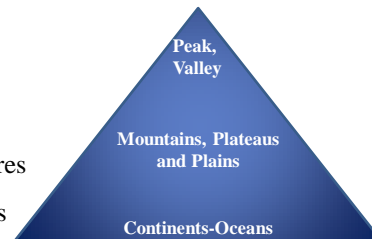
**A] Based on *dimensions and scale*....core subject matter of geomorphic study can grouped in to**

Three broad category..

1] First Order Relief Features

2] Second Order Relief Features

3] Third Order Relief Features



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### ***1] First Order Relief Features:***

- ❖ Relief features on the largest scale, consisting of continental platforms and ocean basins
- ❖ Continents and Oceans basins are first order relief features-World Geomorphology
- ❖ Continental drift due to forces comes from within the earth
- ❖ Plate tectonic – from outer source ( tidal and gravitational force)
  - ❖ Bothe are desirable to analysis or study major morphological features of the earth surface.
  - ❖ Plate tectonic helps to understand the origin of continents and oceans basins.

#### **FIRST ORDER OF RELIEF**



are those that are BIG and VAS continents and ocean basins.

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Major tectonic plates of the world.



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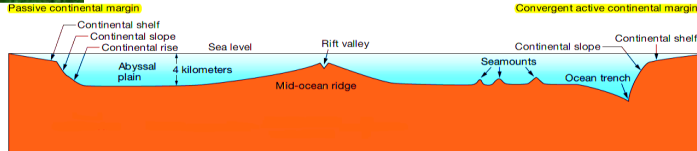
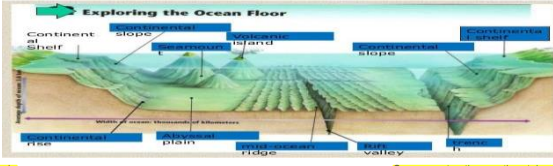
**Second Order Relief Features:**

- Forms developed on Continents and Ocean basin
- Forms developed on continent such as—
  - Mountain, Plateaus, lakes, fault, rift valley.
- These forms formed due to androgenetic forces (diastrophic forces)
  - In the ocean basins,
    - the second order of relief includes continental rises, slopes, abyssal plains, mid-ocean ridges, submarine canyons, and subduction trenches.



**The Ocean Basin Floor**

1. Abyssal floor
2. Seamounts and Guyots

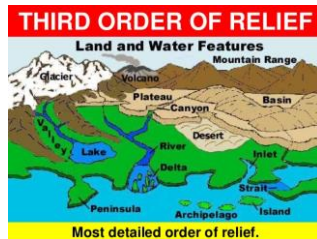


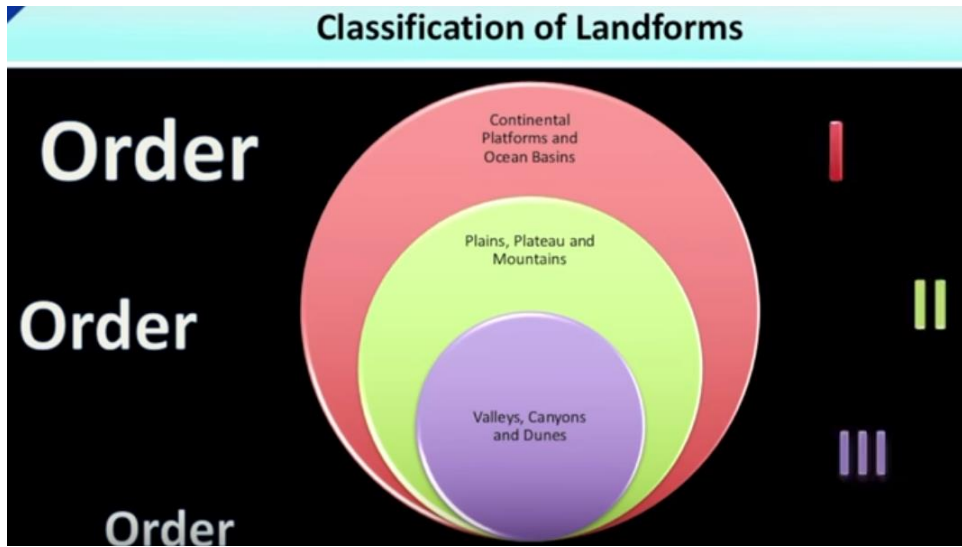
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**3) Third Order Relief Features:**

- Micro-level landforms developed on second order relief features, by Exogenetic denudational process originating from atmosphere.
- These Landforms may be...
  - Erosional:
    - Agents of Erosion River, Glacial, Wind, Ocean waves, ground water
    - river, karst & glacial valley, canyons, gorges, terraces, yardang
  - Depositional:
    - flood plains, delta, levees, beaches, sand dunes, stalagmites
  - Residual:
    - Monadnocks, inselbergs

- The third order of relief includes... individual peaks, cliffs, valleys, hills, spurs, gorges, sand dunes, caves, moraines, cirques, ripples, beaches, etc.
- These features are identified as local landscapes.





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**B) Process that shape landforms:**

❖ **Geomorphic Process-both...**

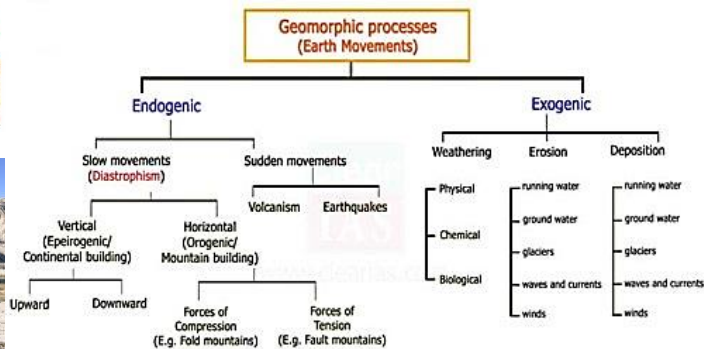
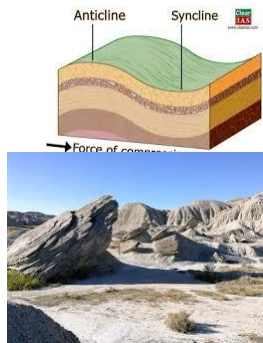
- ❖ endogenous and
- ❖ exogenous,
- ...that shape landforms.

Davision openian ....Landscape is function of structure, process and time

$$L=F(S,P,T)$$

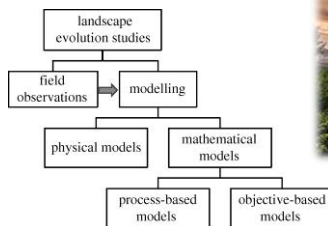
Systematic investigation of....

- Geomorphological Processes (Denudational)
- Geothermal (lithology)
- Time factor



### C] The approaches to the geomorphic study:

- Geomorphic Study Incorporate two major approaches...
  - ❖ **Historical Study (Approach):**
    - Concerning... historical evolution of landforms
  - ❖ **Functional Study (Approach):**
    - Concerning...time-independent series of landform evolution, reflect association between ...
    - **Landform characteristics** and existing **environmental conditions**.
- Both approaches have... relevance in geomorphological investigations.



### Introduction

- ❖ To understand nature of geomorphology, we need to study the history of its development as discipline of geography.
- ❖ Geomorphology emerged as a scientific discipline in the latter part of the 19th century, and rapidly developed from the early 20th century under the dual influence of its parent disciplines, geology and geography.
- ❖ According to time nature of subject has been changed,
- ❖ millstones changes exhibit the changing nature of geomorphology.
- ❖ These changing millstones are.....

Main two Contributors to shape this discipline...

#### 1] Albrecht Penck:

- German Geographer dedicated to Geomorphology and climatology
- Introduce Geomorphology as new branch in end 19<sup>th</sup> Century.



**Albrecht Penck**  
(25 September 1858  
– 7 March 1945)

#### 2] James Hutton:

- British Geologist, physician, chemical manufacturer, naturalist, and experimental agriculturalist.
- Father of Geomorphology as contributed to begin the study of Geomorphological aspect of Earth without name of Geomorphology
- Fundamental contribution to subject is “Theory of uniformitarianism”



**James Hutton**  
(3 June 1726  
26 March 1797)

## Points to explain the nature of Geomorphology.....

- 1} **Descriptive & Interpretative nature** (Qualitative Observations):  
Roman and Greek Period BC
- 2} **Dark Age**
- 3} **Dynamic Nature**-Voyage & Discovery of New land-
- 4} **Toward Scientific nature:** (1700 to 1800)
- 5} **Complete Scientific Nature** (18<sup>th</sup> & 20<sup>th</sup> century)
- 6} **Interdisciplinary Nature** (20<sup>th</sup> & 21<sup>st</sup> century)
- 7} **Laboratory and Field Work nature**
- 9} **Qualitative and Quantitative nature**
- 10} **Applied Nature**

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Ref. The Nature of Geomorphology by A F Pitty

### 1} **Descriptive & Interpretative nature** (Qualitative Observations):

Roman and Greek Period BC

❖ geographers from these country made qualitative observation of landforms – embankment of landform study

□ Examples:

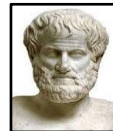
➤ **Herodotus: Greek historian**

- lived in the fifth century BC (484–425 BC)
- Describe deposition of sediment in Nile River basin and said that **Egypt is "gift of the Nile"**



➤ **Aristotle (4<sup>th</sup> Century):**

- describe about the movement of land with reface to ocean..
- demonstrated that the Earth had a spherical shape.



➤ **Strabo:** (64 or 63 BC – AD 24)

- notable for his work Geographica ("Geography"),
- presented a descriptive history of people and places from different regions of the world known to his era



So, in this period various philosophers described landforms and given interpretation which was indirect beginning of descript geomorphology.

## 2} Dark Age:

- The Dark Ages, is the period between the fall of the Roman Empire and the beginning of the Age of Exploration.
- Roughly speaking, from 500 to 1500 AD.
- No remarkable research about geomorphology.



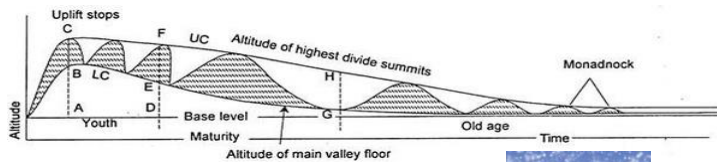
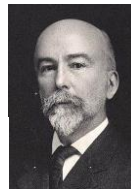
## 3} Dynamic Nature- Voyage & Discovery of New land:(15<sup>th</sup> Century)

- Due to Voyage and discovery of new land by European explorer, new observations established about landforms.
  - The Age of Discovery, or the Age of Exploration -which extensive overseas exploration emerged as a powerful observation.
  - Assessment of old knowledge and comparative study started.
  - In Geomorphology... 'landforms change continually through erosion' principal introduced which is strongly influenced on nature of geomorphology
- **William Baffin:** English navigator and explorer.. rivers reduced height of land up to sea level and age of earth is much more then mentioned in Bible.



## 4} Toward Scientific nature: (1700 to 1800)

- 'Rivers execute erosion and deposition work' this fact was accepted by all geographers
  - James Hutton (June 3, 1726-March 26, 1797)
  - Father of Modern Geology and founder of "Theory of Uniformitasm"
  - 'Present is Key of Past'
  - Father of Geomorphology.
- ❖ William M. Davis(1850–1934)
- Scientific contribution was the "geographical cycle" Cycle of Erosion
  - idealized model that explains the development of relief in landscapes.



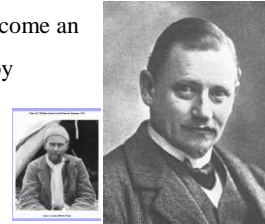
- ❖ **19<sup>th</sup> Century: Louis Agassiz's (1807-1873)**
  - concept of a "Great Ice Age"
  - Swiss-American biologist and geologist



### 5) Complete Scientific Nature (19<sup>th</sup> & 20<sup>th</sup> century)

At the end of 19<sup>th</sup> century...

- ❑ Albrecht Penck (25 September 1858 – 7 March 1945)
- ❑ was a German geographer and geologist
- ❑ In this century, landforms have been studied in detail,
- ❑ produced lot of theoretical information
- ❑ Penck introduced name Geomorphology for total knowledge of landform
- ❑ W M Deise theory and Penck’s theory of Cycle of Erosion become an central part of geomorphology and many more contributions by Geomorphologist, geologist and geographers.
- ❑ Those shaped nature of geomorphology as science.



Walther Penck (30 August 1888 – 29 September 1923) :

- geologist and geomorphologist known for his theories on landscape evolution.
- criticizing key elements of the Davisian cycle of erosion, with concluding that the “process of uplift and denudation occur simultaneously, at gradual and continuous rates.”

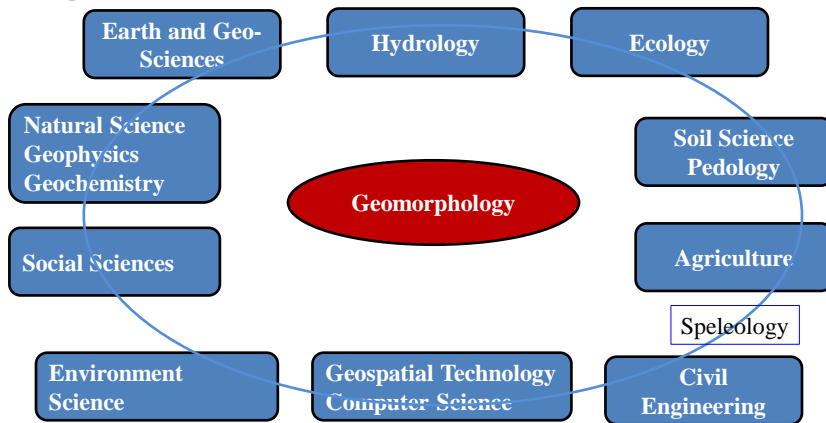
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geomorphology became an increasingly exact science.

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### 6) Interdisciplinary Nature (20<sup>th</sup> & 21<sup>st</sup> century)

- As geomorphology evolved, it became more interdisciplinary.
- Following diagram showing the interdisciplinary nature of geomorphology.
- Geomorphology is an interdisciplinary science that overlaps into many scientific disciplines.



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### 7) Laboratory and Field Work nature

- field work is essential to understand geomorphological data and ground validation
- Laboratory work conduct to design experiment to assessment and produce data.



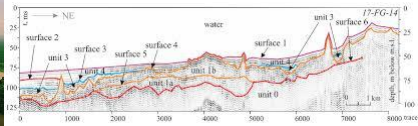
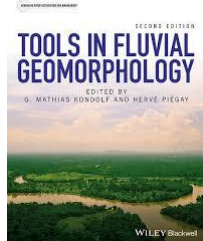
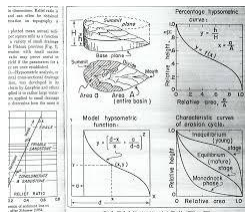
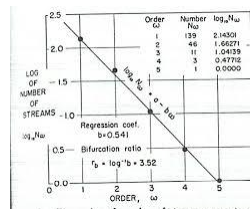
### 9) Qualitative nature

- ❖ Application of statically techniques and method to study geomorphological feature and process.
- ❖ Statistical modeling of geomorphological data to established scientific theory.

$$\frac{\partial S}{\partial t} = g \frac{\partial^2 S}{\partial x^2}$$

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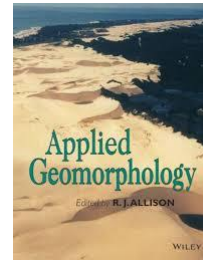
$$\frac{\partial S}{\partial t} = g \frac{\partial^2 S}{\partial x^2}$$





## 10} Applied Nature:

- ❑ **Applied geomorphology** is a field of science....
  - where the research outcomes provide information geomorphic landforms or processes
- ❑ that may be of concern to society
- ❑ provides solutions to problems of **geomorphic** context



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