Chapter One

Geomorphological Processes and Environments

What we see on the earth's natural *surface?*

Various landform features

- Landforms? Which? & Where?
- How these features are formed?

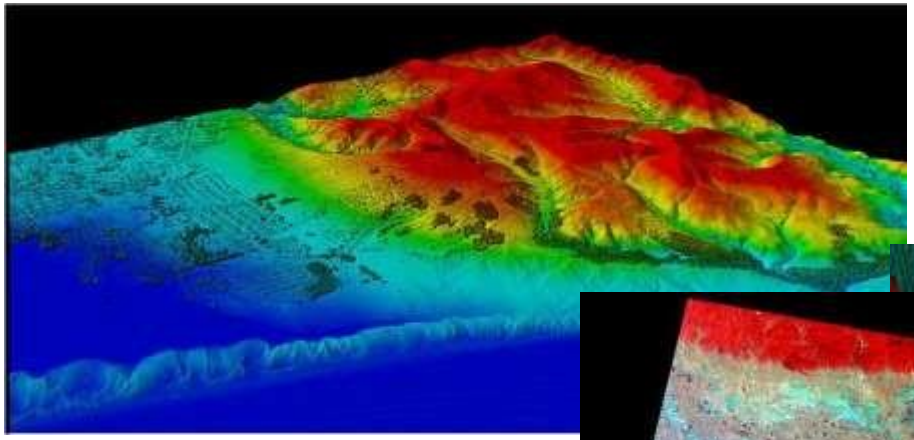
Geomorphology

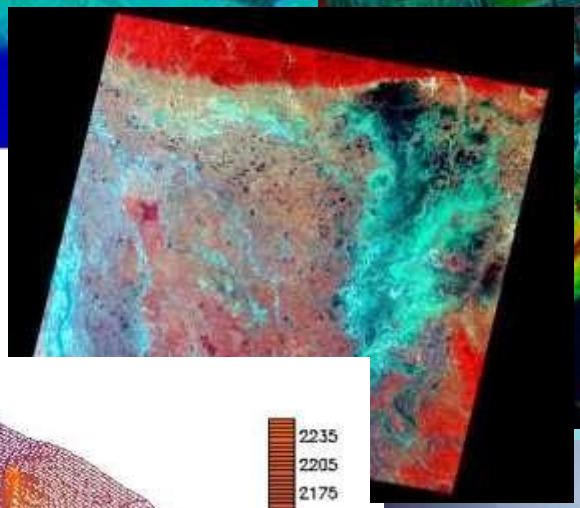
- The word Geomorphology derived from Greek: *geo*, "earth"; *morfé*, "form"; and *logos*, "study"; is the scientific study of landforms and the processes that shape them.
- It is a composite science, is the study of landforms including, in recent times especially, investigations into the processes that cause and alter the landforms.
- Geomorphology is practiced within physical geography, geology, geodesy, engineering geology, archaeology and geotechnical engineering.

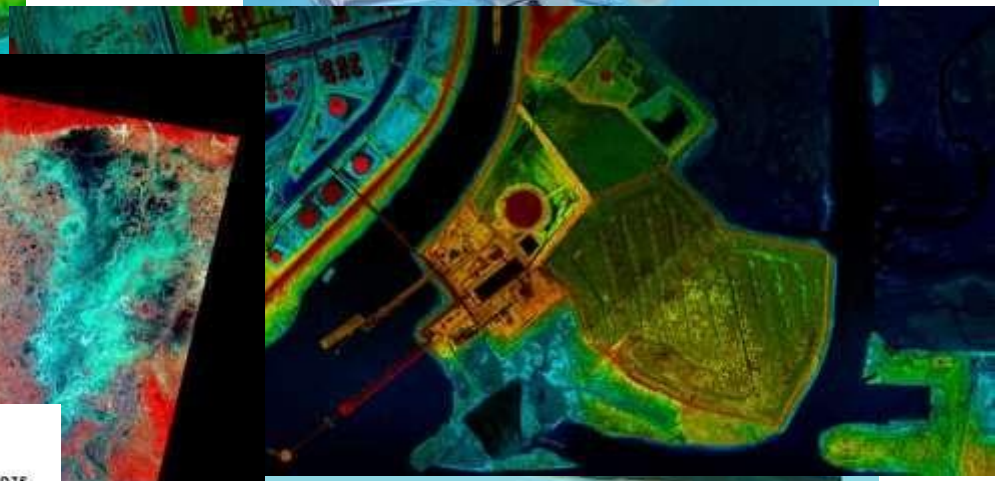
Why Geomorphology?

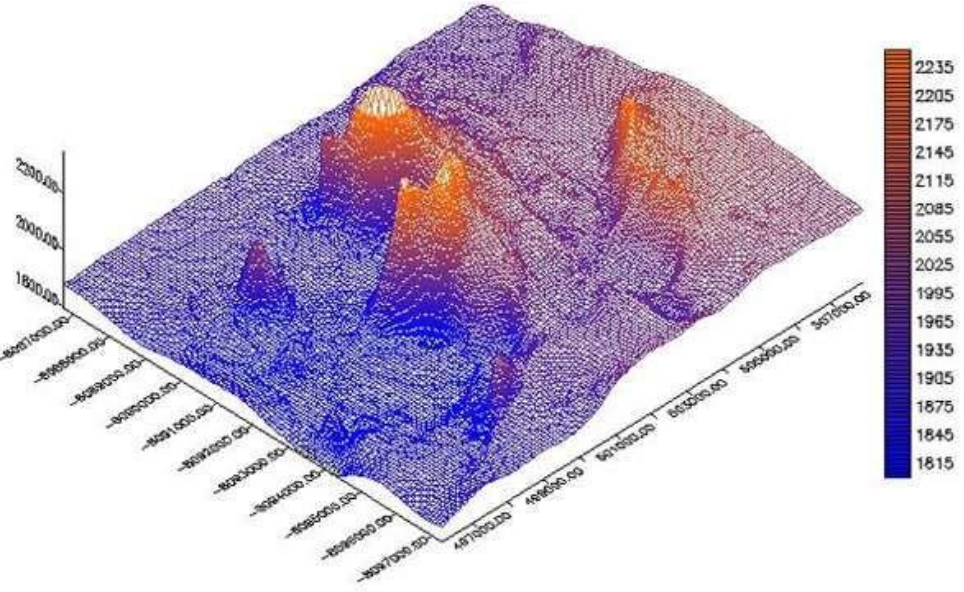
- To understand geomorphological processes of various environment.
- To detect natural and environmental hazards efficiently, e.g. earthquake, flooding, landslide, tsunami, volcanism etc.
- To identify various landform features and landscapes
- To identify various landform features from satellite images
- Coastal and river research
- Vulnerability studies

Applications of Geomorphology









- What are the processes work behind the landforms?

Geomorphic Process

- The process responsible for the formation and alteration of the earth's surface.
- The physical and chemical interactions between the earth's surface and the natural forces acting upon it to produce landforms.
- The processes are determined by such natural environmental variables as geology, climate, vegetation and base level, to say nothing of human interference.

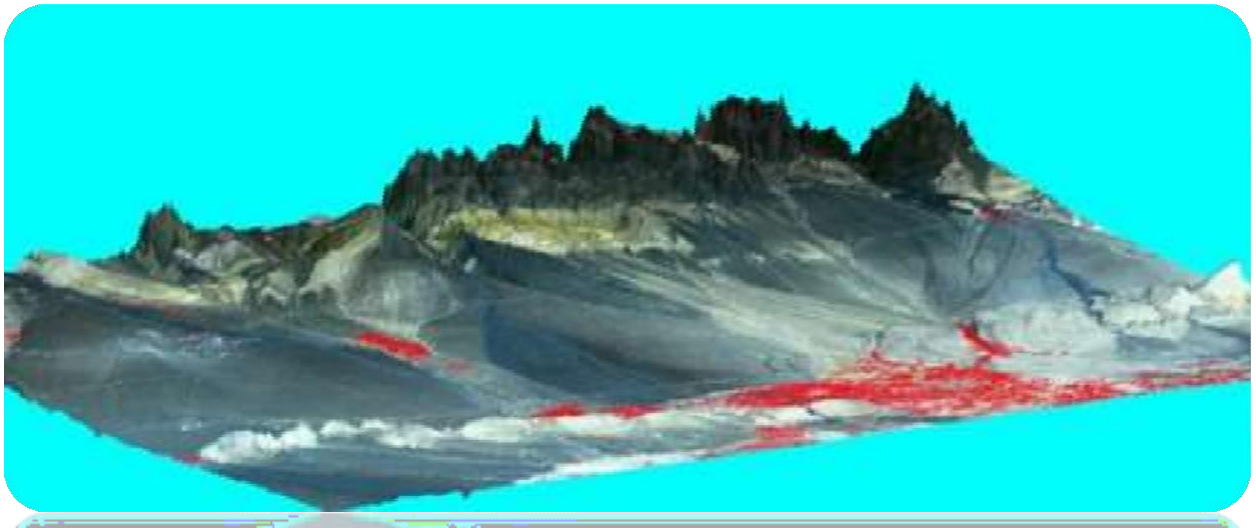
Geomorphic Process (Cont…)

Definition:

- The geomorphic processes are all those physical and chemical changes which effect a modification of the earth's surgical form [W. D. Thornbury (1968): Principles of Geomorphology, pp. 34].
- A process by which the earth's land forms are changed or maintained [Jim Gardner (1979): Physical Geology].

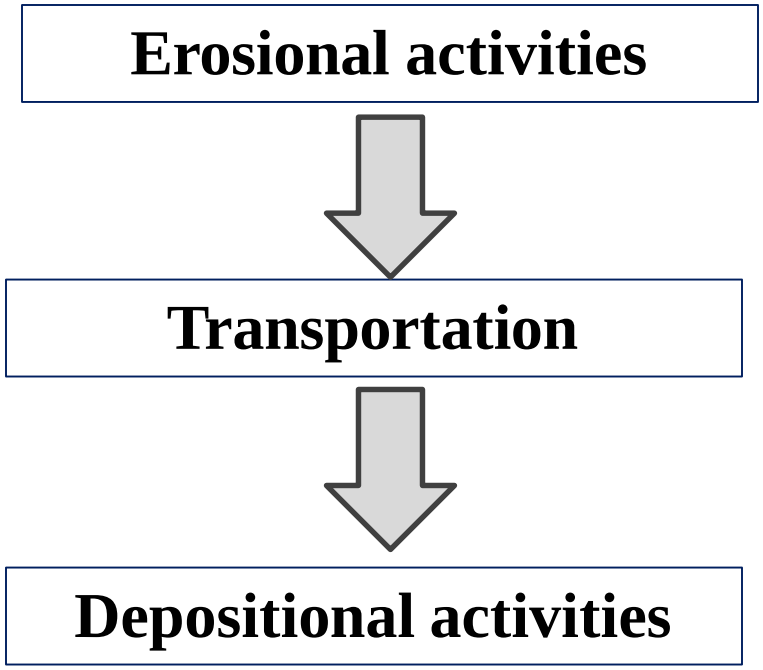
Agent of Geomorphological Processes

- River activities- **Humid Geomorphic Environment**
- Wind activities - **Arid Geomorphic Environment**
- Glacier activities - **Glacial and Peri-Glacial Geomorphic Environments**
- Wave activities - **Marine and Coastal Geomorphic Environment**

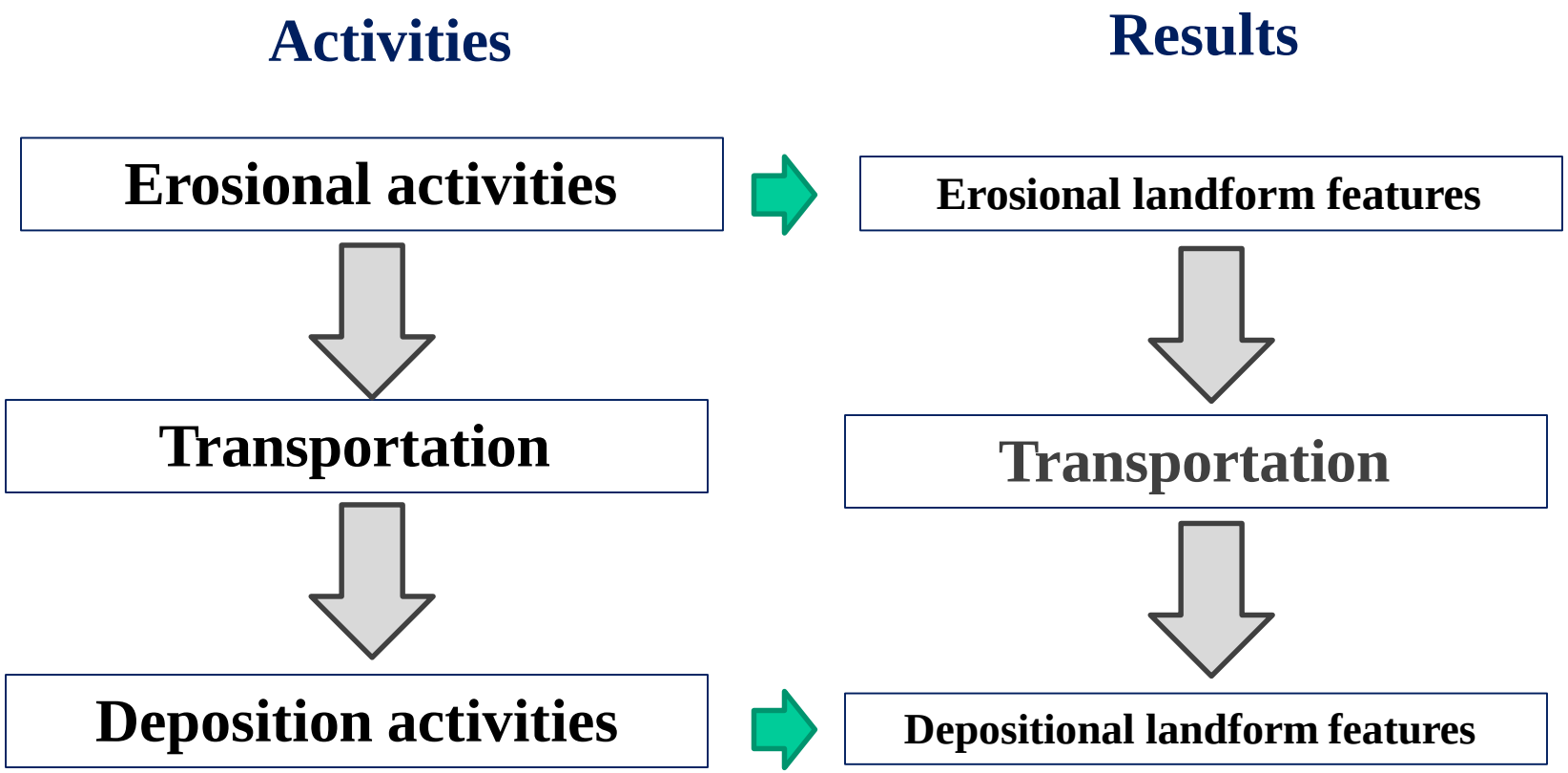


Activities of the Agent of Geomorphic Processes

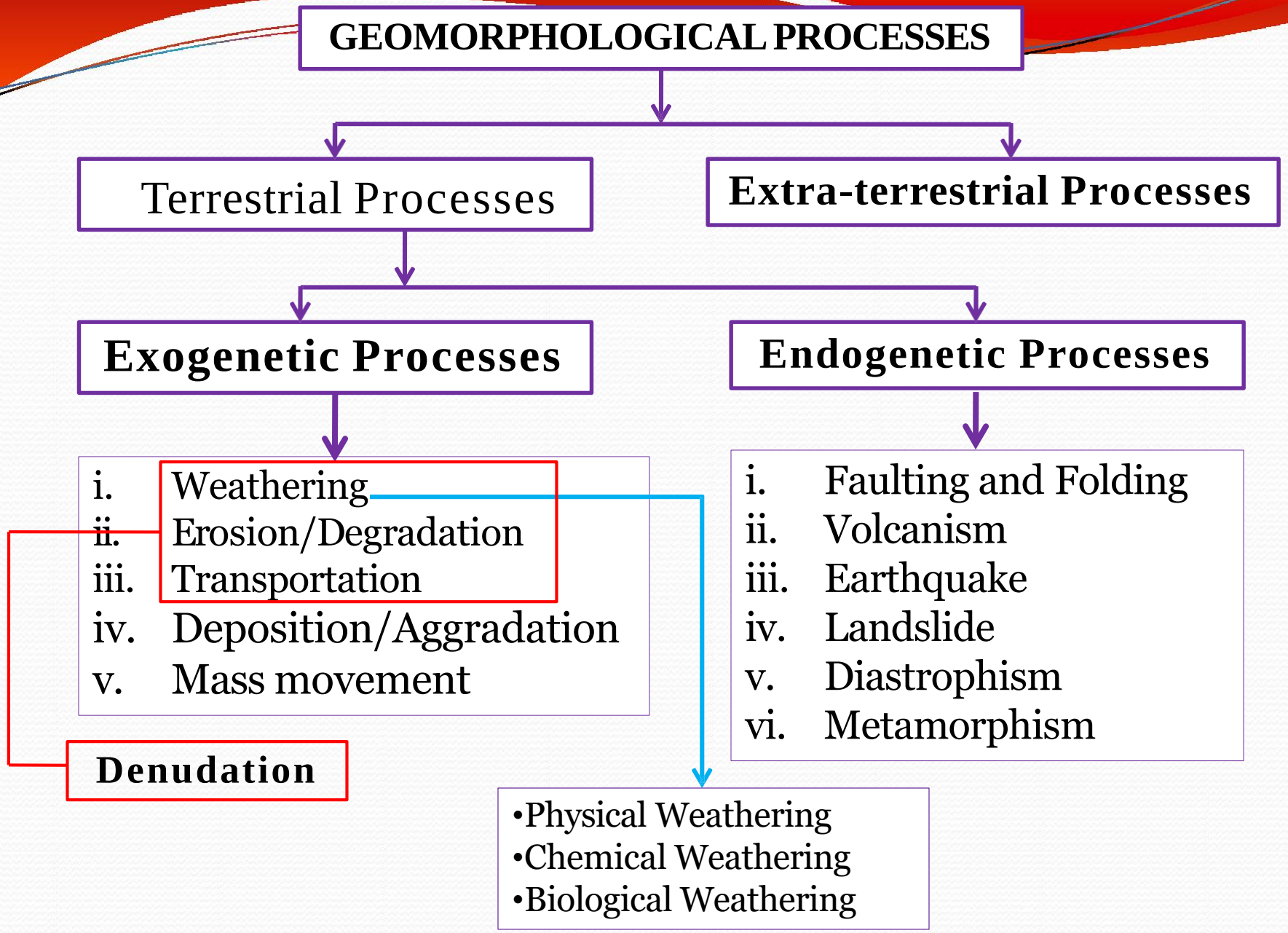
Three types of activities are done



Activities of the Agent of Geomorphic Processes



Agents of Change...


GEOMORPHOLOGICAL PROCESSES
Terrestrial Processes
Extra-terrestrial Processes
Exogenetic Processes
Endogenetic Processes
i. Weathering
ii. Erosion/Degradation
iii. Transportation
iv. Deposition/Aggradation
v. Mass movement
Denudation
•Physical Weathering
•Chemical Weathering
•Biological Weathering
i. Faulting and Folding
ii. Volcanism
iii. Earthquake
iv. Landslide
v. Diastrophism
vi. Metamorphism

Types of Geomorphic Processes

- **Geomorphic Processes**

A. Terrestrial processes

B. Extra-terrestrial processes, e.g. fall of meteorite (mass/rock from outer space).

Terrestrial processes

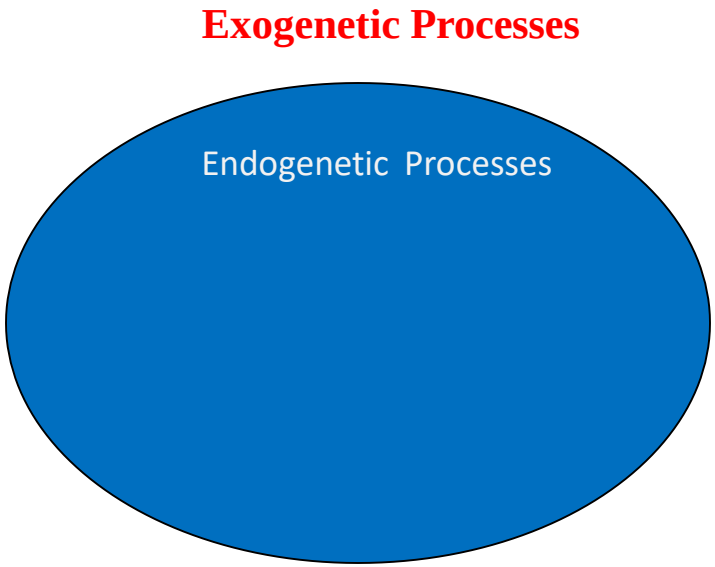
1. Exogenetic / Exogenous Processes
2. Endogenetic / Endogenous Processes

Extra-terrestrial processes, e.g. fall of meteorite

Types of Geomorphic Processes (Cont…)

Exogenetic/Exogenous Processes

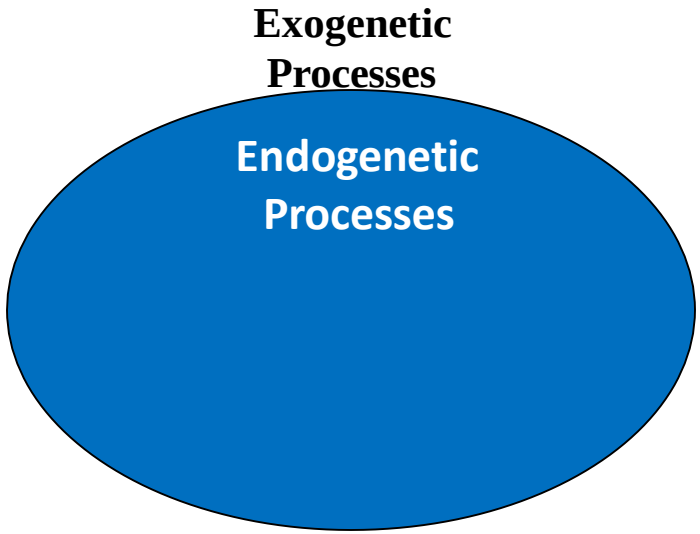
Outer geomorphological processes = exogenetic processes (solar radiation, wind, temperature changes, water) create relief sculptures, surface features.



Types of Geomorphic Processes (Cont…)

Endogenetic Processes

Inner geomorphological processes = endogenetic processes (earthquakes, volcanoes, folding and faulting) create rough features of the Earth´s relief. e.g. oceanic basins, mountain ranges, oceanic ridges and trenches, rift valleys, folds, faults and volcanoes, etc.



Basic difference between the two process

- Processes that are caused by forces from within the Earth are **endogenous** processes.
- By contrast, **exogenous** processes come from forces on or above the Earth's surface.

Endogenic Processes	Exogenic Processes
Originate in the interior of the earth.	Originate on the surface of the earth.
Causes sudden or rapid movements	Causes slow movements.
Eg: Earthquake, faulting, diastrophism	Eg: Erosional and Depositional

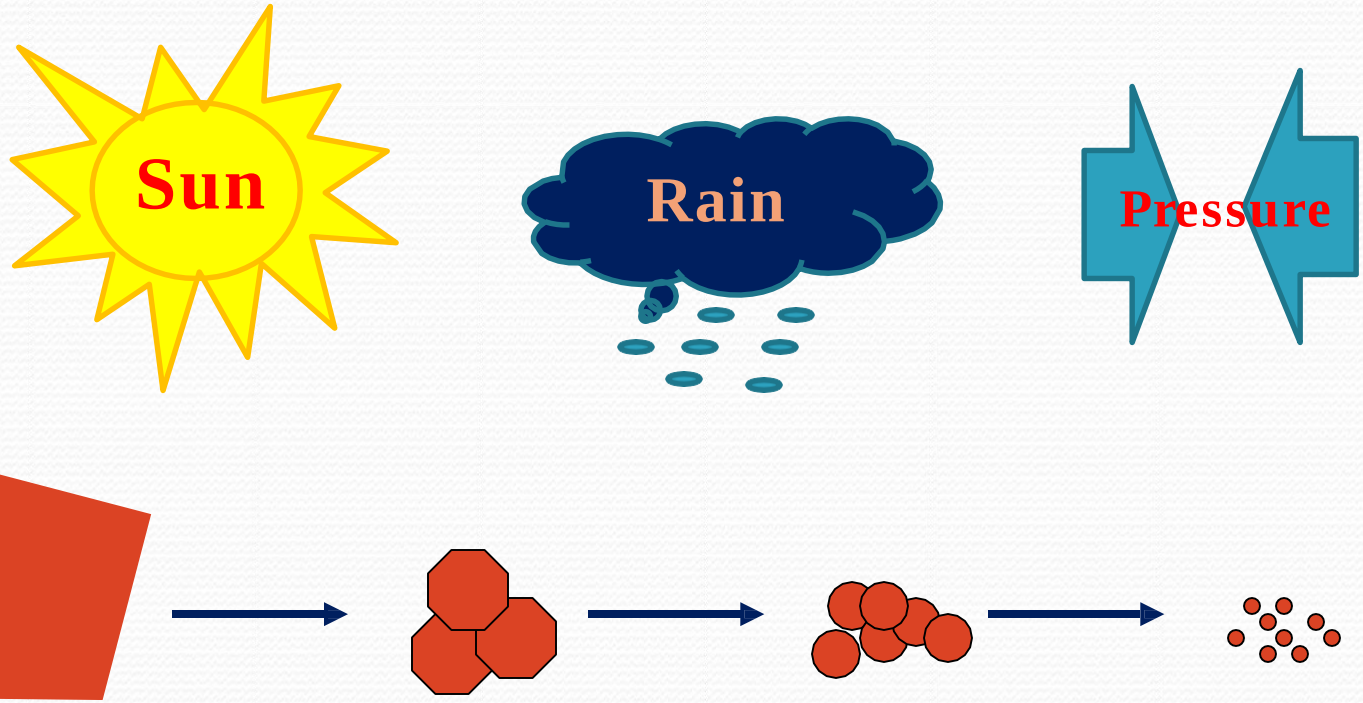
Types of Exogenetic / Exogenous Processes

i. Weathering
ii. Erosion/ Degradation
iii. Transportation
iv. Deposition/Aggradation
v. Mass movement

Denudation

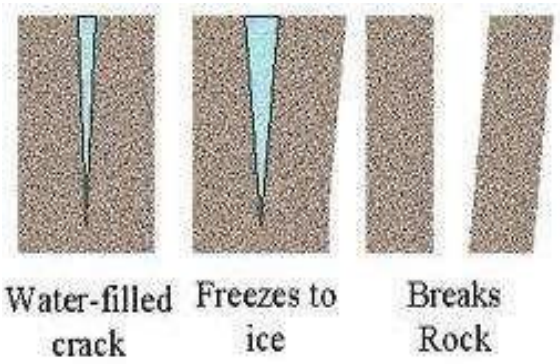
- It means to make the things exposed.
- The processes by which the rocks on the earth's surface are broken into pieces through the application of external physical forces and the debris are transported elsewhere is known as denudation.
- This denudation work is performed through three processes such as weathering, erosion and transportation.
- **Denudation=** Weathering + Erosion + Transportation

Weathering

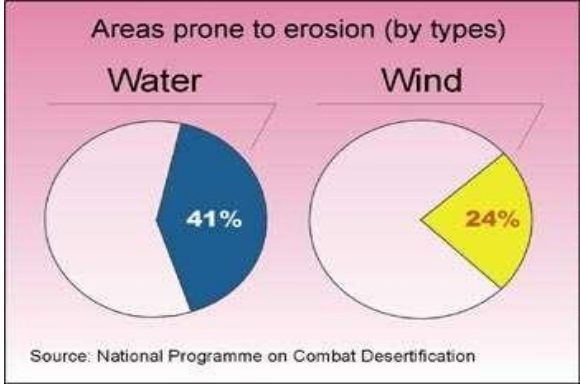


Weathering

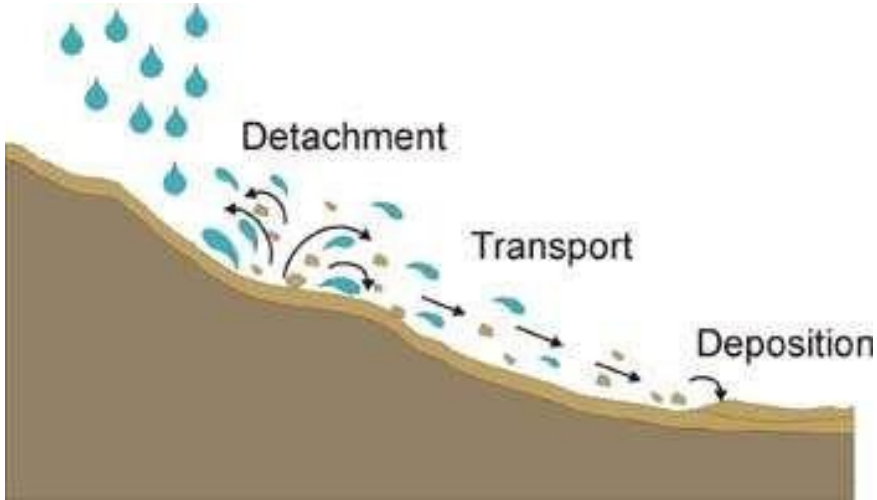
- The weathering is a process by which the rocks on the surface of the earth is broken mechanically into pieces due to snow or frost, the variation of temperature and pressure or due to chemical (dissolution) action on the materials.
- Even the rocks are dislodged by the animals. But the rocks weathered this way, are not transported elsewhere.

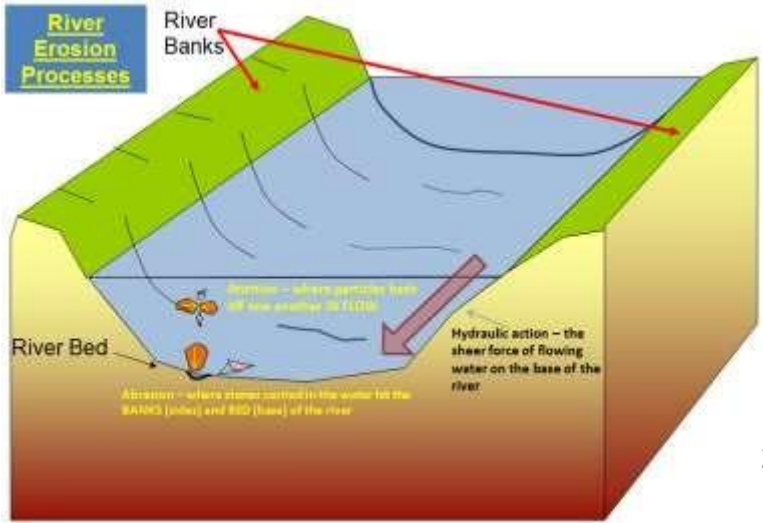


Erosion



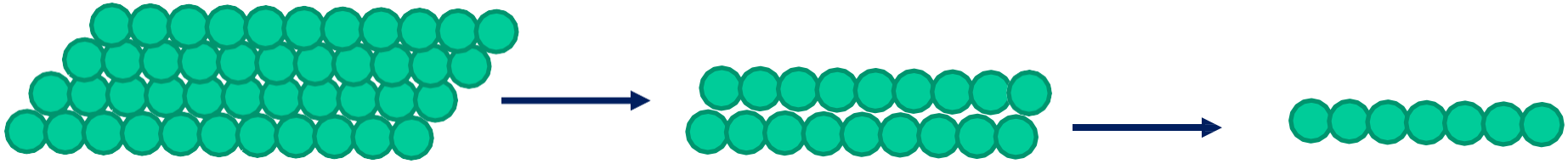
- Erosion and transportation are accomplished together.
- The process by which the rocks of the earth's crust are eroded by the river, wind, glacier, ocean currents etc. are transported elsewhere is known as erosion.





Degradation

- Degradation is the lowering of a bottomland surface through the process of erosion;
- Conceptually it is the opposite of the vertical component of aggradation and is most frequently applied to sediment removed from a channel bed or other low-lying parts of a stream channel.

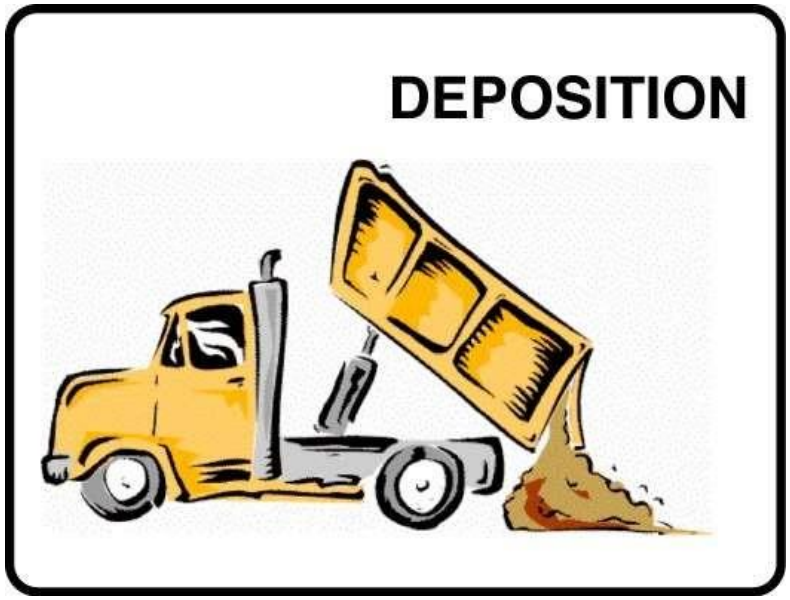


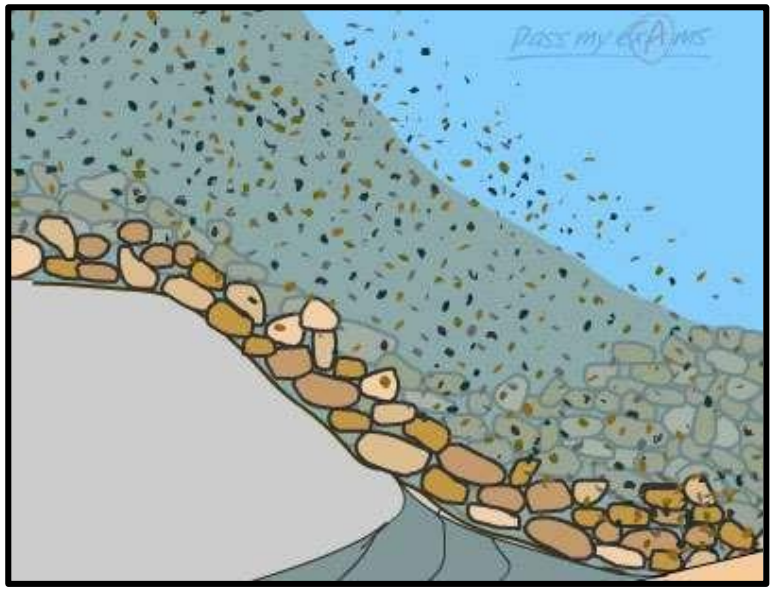
Weathering vs. Erosion

- Weathering = process of disintegration or decomposition of rocks which stay then in the same place.
- Erosion = process of disintegration or decomposition of rocks which are transported somewhere else.

Deposition

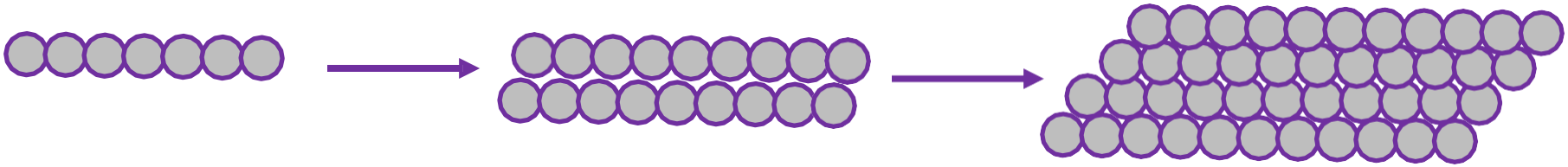
Deposition is the constructive process of accumulation into beds or irregular masses of loose sediment or other rock material by any natural agent;





Aggradation

- Aggradation is the raising or elevating of a bottomland surface through the process of alluvial deposition;
- Conceptually it is the vertical component of accretion and is most frequently applied to sediment deposition on a channel bed, bar or other near-channel surfaces, flood plain, or, less often, low-lying alluvial terrace.

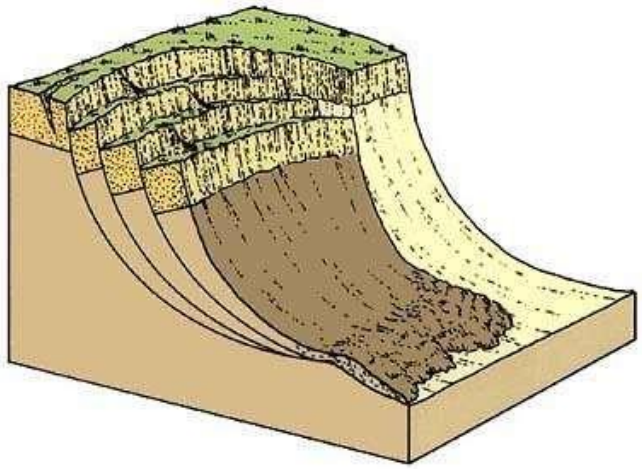


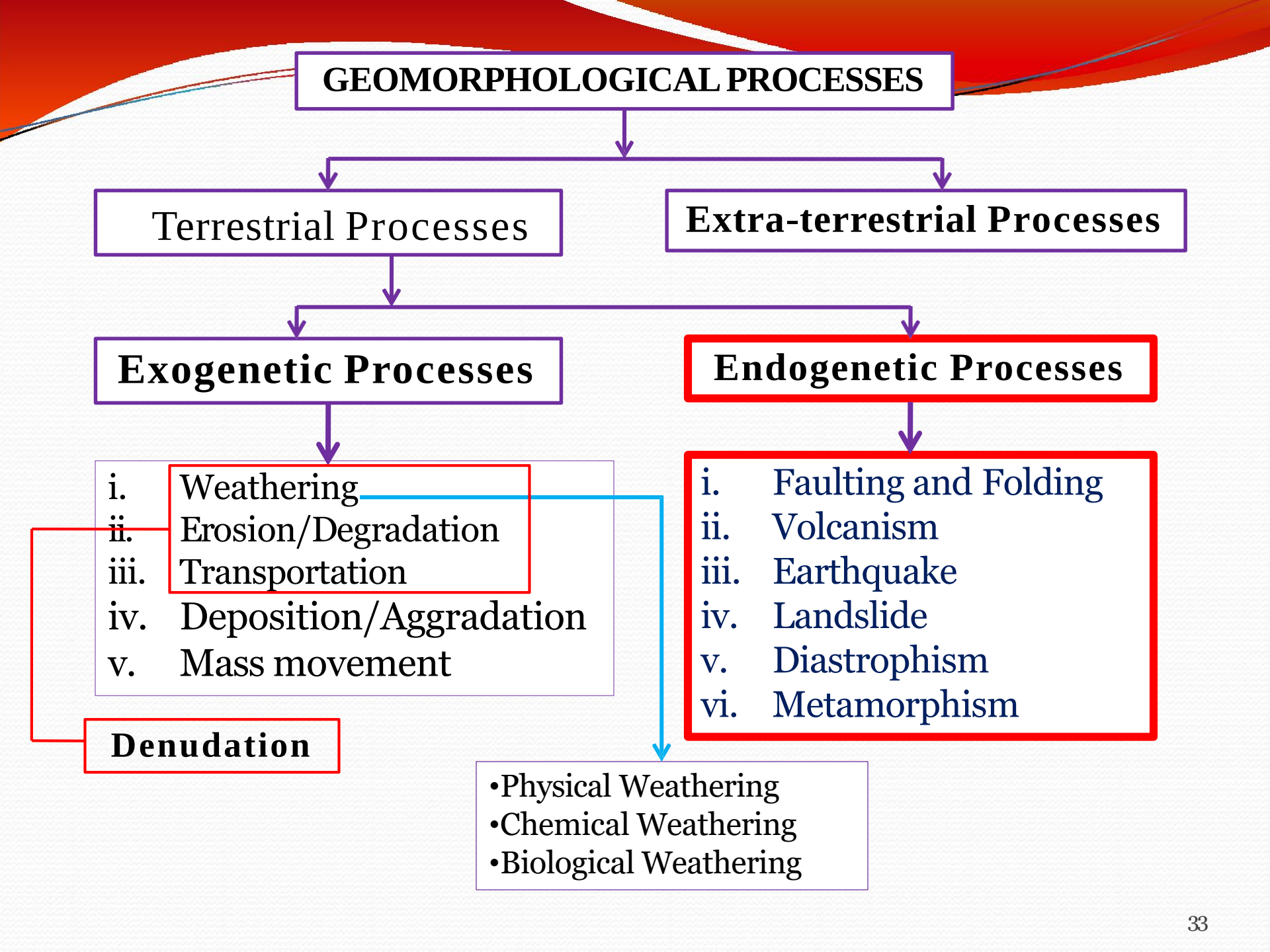
Sedimentation

- Sedimentation is the process by which sediment is mechanically deposited from suspension within a fluid, generally water, or ice, thereby accumulating as layers of sediment that are segregated owing to differences in size, shape, and composition of the sediment particles.

Mass movement/Mass Wasting

- **Mass movement** is any downslope transfer, through gravitational and generally water-facilitated (viscous) processes, of near-surface soil and rock material;
- Rates of mass movement range from very slow creep to nearly
- instantaneous slope failure.

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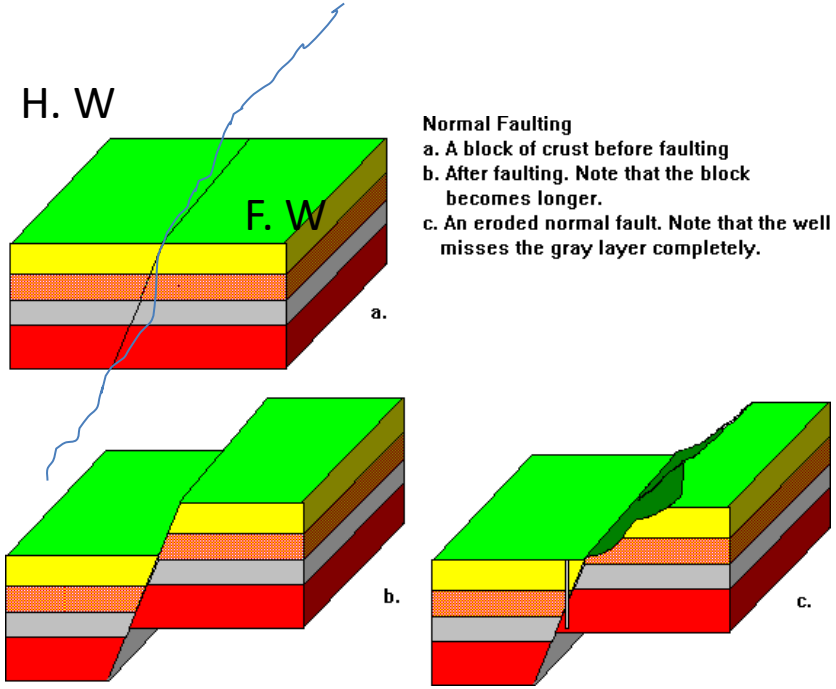
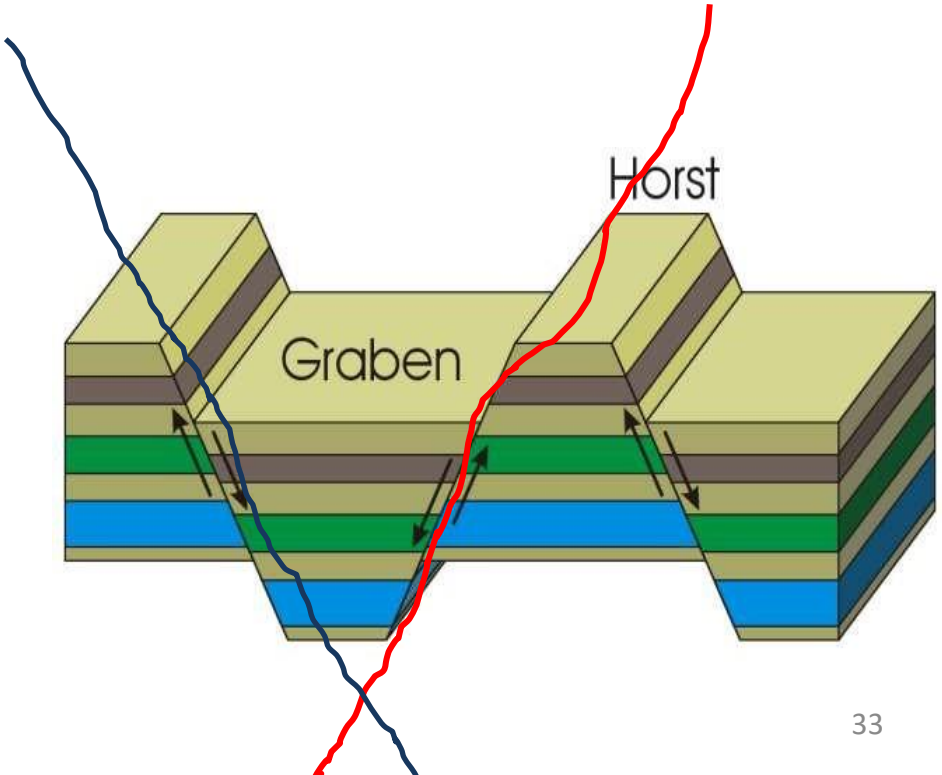
Faulting

- Fault is a planar or gently curved fracture in the rocks of the earth's crust, where compressional or tensional forces cause relative displacement of the rocks on the opposite sides of the fracture.



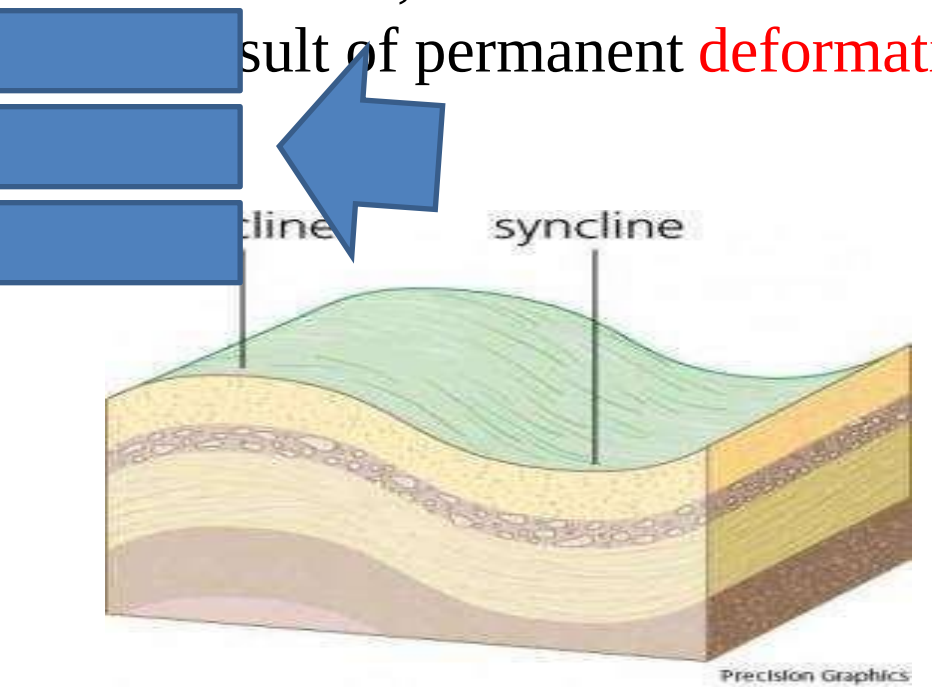
Normal Faulting
a. A block of crust before faulting
b. After faulting. Note that the block becomes longer.
c. An eroded normal fault. Note that the well misses the gray layer completely.



Folding

- Fold is an undulation or waves in the stratified rocks of the earth's crust.

  A fold occurs when one or a mass of originally flat and planar surfaces, such as sedimentary strata, are bent or curved as a result of permanent deformation.



Volcanism

- Volcanism is the phenomenon of eruption of molten rock (magma) onto the surface of the earth, where lava and volcanic gases erupt through a break in the surface called a vent.
- Eruption of the volcanoes or the magma is the main sources of igneous rocks on the surface of the earth.




Earthquake

- An earthquake is a vibration or oscillation of the surface of the earth caused by sudden release of enormous pressure.

Landslide

- A landslide, also known as a landslip, which includes a wide range of ground movements, such as rock fall, deep failure of slopes and shallow debris flows, which can occur in offshore, coastal and onshore environments.

Diastrophism

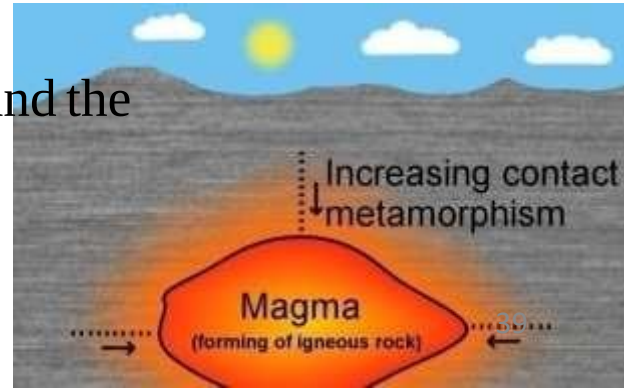
- Diastrophism is also called tectonism, large-scale deformation of earth's crust by natural processes, which leads to the formation of continents and ocean basins, mountain systems, plateaus, rift valleys, and other features by mechanisms such as plate movement, volcanic loading, or folding.
- Internal forces active here

Metamorphism

- Metamorphism is the change in rock structure, minerals or geologic structure.

- It is a process of change in the physical structure of rock as a result of long-term heat, pressure and introduction of chemically active fluids, especially a change that increases the rock's hardness and crystalline structure.

- The change occurs primarily due to heat, pressure, and the introduction of chemically active fluids.



Geomorphological Processes at a glance