EROSION & DEPOSITIONAL FEATURES

Erosion is the displacement of solids (soil, mud, rock and other particles) by the agents of ocean currents, wind, water, or ice by downward or down-slope movement in response to gravity or by living organisms (in the case of bioerosion).

Erosion is distinguished from weathering, which is the decomposition of rock and particles through processes where no movement is involved, although the two processes may be concurrent.





Erosion is an intrinsic natural process but in many places it is increased by human land use. Poor land use practices include deforestation, overgrazing, unmanaged construction activity and road or trail building. However, improved land use practices can limit erosion, using techniques like terrace-building and tree planting.

A certain amount of erosion is natural and, in fact, healthy for the ecosystem. For example, gravels continuously move downstream in watercourses. Excessive erosion, however, does cause problems, such as receiving water sedimentation, ecosystem damage and outright loss of soil.

Erosion Processes:

There are different types of erosion processes. Some major erosion processes are as follows:

- Gravity erosion
- Water erosion
- Shoreline erosion
- Ice erosion
- Wind erosion

These processes are briefly described below:

1. Gravity Erosion:

a. Mass wasting:



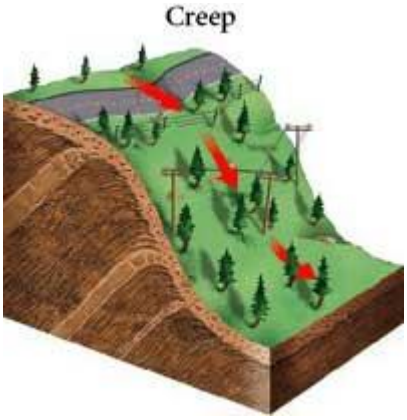
Mass wasting is the down-slope movement of rock and sediments, mainly due to the force of gravity. Mass wasting is an important part of the erosional process, as it moves material from higher elevations to lower elevations where transporting agents like streams and glaciers can then pick up the material and move it to even lower elevations. Mass-wasting processes are occurring continuously on all slopes; some mass-wasting processes act very slowly; others occur very suddenly, often with disastrous results. Any perceptible down-slope movement of rock or sediment is often referred to in general terms as a landslide.

b. Slumping:



Slumping happens on steep hillsides, occurring along distinct fracture zones, often within materials like clay that, once released, may move quite rapidly downhill. They will often show a spoon-shaped depression, in which the material has begun to slide downhill. In some cases, the slump is caused by water beneath the slope weakening it. In many cases it is simply the result of poor engineering along highways where it is a regular occurrence.

c. Surface creep:



Surface creep is the slow movement of soil and rock debris by gravity which is usually not perceptible except through extended observation. However, the term can also describe the rolling of dislodged soil particles 0.5 to 1.0 mm in diameter by wind along the soil surface.

2. Water erosion

- Water is the most important erosional agent and erodes most commonly as running water in streams.
- Raindrops create splash erosion that moves tiny particles of soil.
- Water collecting on the surface of the soil collects as it moves towards tiny rivulets and streams and creates sheet erosion.
- The faster water moves in streams the larger objects it can pick up and transport.

a. Splash erosion:



Splash erosion is the detachment and airborne movement of small soil particles caused by the impact of raindrops on soil.

b. Sheet erosion:



Sheet erosion is the result of heavy rain on bare soil where water flows as a sheet down any gradient, carrying soil particles. Where precipitation rates exceed soil infiltration rates, runoff occurs. Surface runoff turbulence can often cause more erosion than the initial raindrop impact.

c. Gully erosion:

Gully erosion results where water flows along a linear depression eroding a trench or gully.



d. Valley or stream erosion:



Valley or stream erosion occurs with continued water flow along a linear feature. The erosion is both downward, deepening the valley, and headward, extending the valley into the hillside. In the earliest stage of stream erosion, the erosive activity is dominantly vertical, the valleys have a typical V cross-section and the stream gradient is relatively steep. When some base level is reached, the erosive activity switches to lateral erosion, which widens the valley floor and creates a narrow floodplain. The stream gradient becomes nearly flat, and lateral deposition of sediments becomes important as the stream meanders across the valley floor. In all stages of stream erosion, by far the most erosion occurs during times of flood, when more and faster-moving water is available to carry a larger sediment load. In such processes, it is not the water alone that erodes: suspended abrasive particles, pebbles and boulders can also act erosively as they traverse a surface.

3. Shoreline erosion:

Shoreline erosion, which occurs on both exposed and sheltered coasts, primarily occurs through the action of currents and waves but sea level (tidal) change can also play a role.
a. Hydraulic action: Hydraulic action takes place when air in a joint is suddenly compressed by a wave closing the entrance of the joint. This then cracks it.

b. Wave pounding: Wave pounding is when the sheer energy of the wave hitting the cliff or rock breaks pieces off.

c. Abrasion or corrasion: Abrasion or corrasion is caused by waves launching seaload at the cliff. It is the most effective and rapid form of shoreline erosion (not to be confused with corrosion).

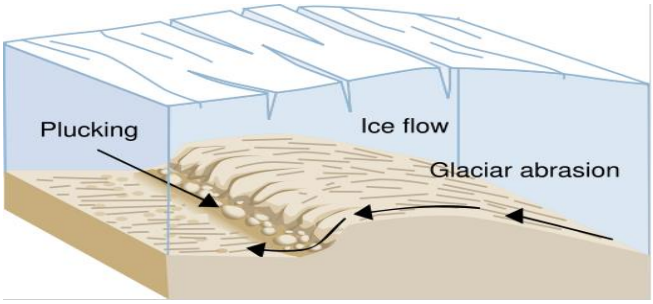
d. Corrosion: Corrosion is the dissolving of rock by carbonic acid in sea water. Limestone cliffs are particularly vulnerable to this kind of erosion.

e. Attrition: Attrition is where particles/seaload carried by the waves are worn down as they hit each other and the cliffs. This then makes the material easier to wash away. The material ends up as shingle and sand. This process also makes them rounder and smoother. The closer the pebbles are to the sea, the more they are going to be affected by attrition

f. Bioerosion:



It is another significant source of erosion, particularly on carbonate coastlines. Bioerosion describes the erosion of hard ocean substrates by living organisms by a number of mechanisms. Bioerosion can be caused by mollusks, polychaete worms, phoronids, sponges, crustaceans, echinoids, and fish. It can occur on coastlines, on coral reefs, and on ships. Mechanisms of bioerosion include biotic boring, drilling, rasping, and scraping.



4. Ice erosion:

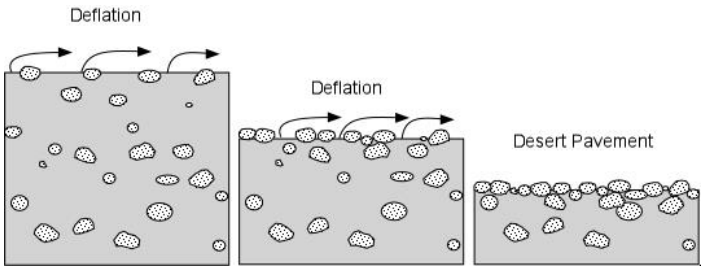
Ice erosion is caused by movement of ice, typically as glaciers. Glaciers erode predominantly by two different processes: abrasion/scouring and plucking. In an abrasion process, debris in the ice scrapes along the bed, polishing and gouging the bedrock, similar to sandpaper on wood. Glaciers can also cause large pieces of bedrock to crack off in the process of plucking. These processed, combined with erosion and transport by the water network beneath the glacier, leave moraines, drumlins and glacial erratics in their wake, typically at the terminus or during glacier retreat.

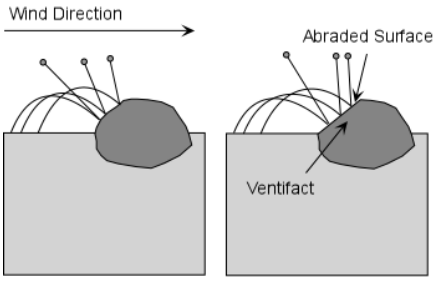
a. Ice wedging: Ice wedging is the weathering process in which water, trapped in tiny rock cracks, freezes and expands, breaking the rock. This can lead to gravity erosion on steep slopes. It is a common engineering problem wherever rock cliffs are alongside roads, because morning thaws can drop hazardous rock pieces onto the road. In some places, water seeps into rocks during the daytime, then freezes at night. Ice expands, thus, creating a wedge in the rock. Over time, the repetition in the forming and melting of the ice causes fissures, which eventually breaks the rock down.



5. Wind erosion:

Wind erosion is the result of material movement by the wind. There are two main effects. First, wind causes small particles to be lifted and therefore moved to another region. This is called deflation. Second, these suspended particles may impact on solid objects causing erosion by abrasion.





Wind erosion generally occurs in areas with little or no vegetation, often in areas where there is insufficient rainfall to support vegetation. An example is the formation of sand dunes, on a beach or in a desert. Windbreaks are often planted by farmers to reduce wind erosion.



Notes:

Dunes: A ridge of sand created by the wind; found in deserts or near lakes and oceans

Moraines: Accumulated earth and stones deposited by a glacier

Drumlins: A mound of glacial drift

Erratics: A boulder of rock that differs from the surrounding bedrock because it has been transported by a glacier

Relation between Weathering and Erosion:

Weathering	Erosion
Production of rock waste in place under virtually static condition	Transportation of rock waste from the site of its formation
Both the processes are parts of a single process called Denundation, i.e., lowering of the surface of earth	
Weathering aids erosion by weakening and disintegrating rocks	Erosion in turn aids weathering by removing the cover of soil & loose debris and exposing them to the weather
Weathering can take place without subsequent erosion and erosion is possible without previous weathering. Weathering is a preparatory process, but neither a prerequisite nor necessarily followed by erosion.	