# Module 8: Weathering, Erosion, and Groundwater
## Topic 4 Content: Erosional Forces Presentation Notes


Erosional Forces

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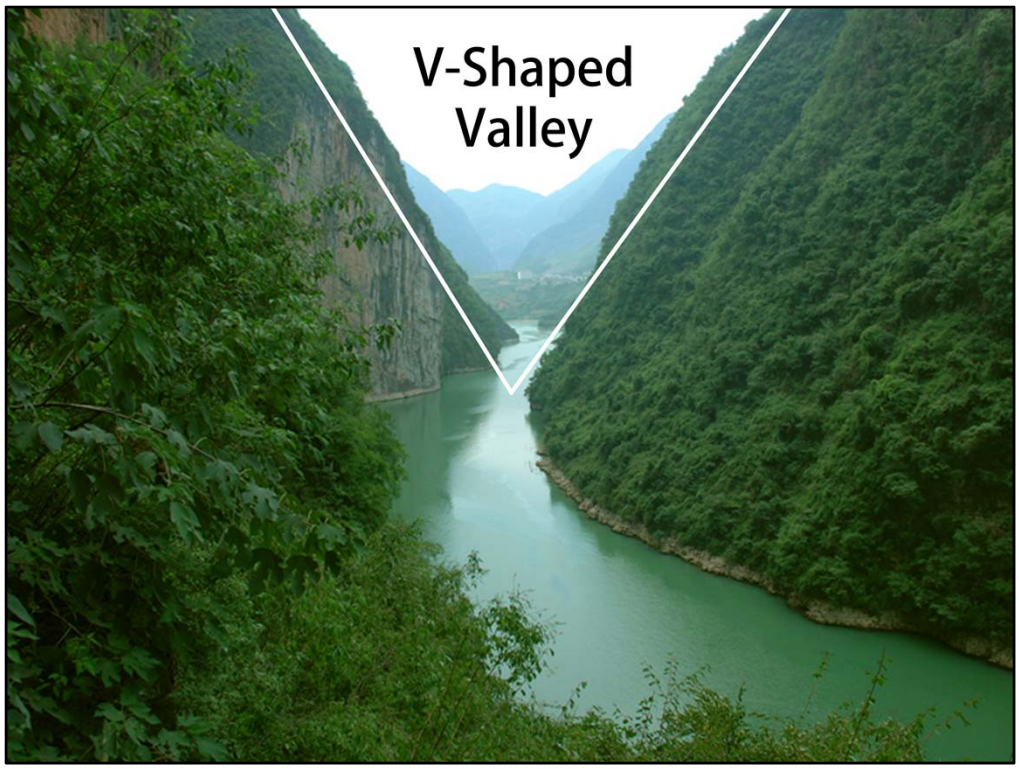
Water is capable of moving rock material when it flows. Water can cause erosion in a few different ways. One method of erosion by water is caused by rivers. Rivers are very effective agents of erosion and are responsible for carving many of the Earth's most impressive features. Rivers are classified according to their development and surrounding terrain. There are three stages of river development: young, mature, and old. Although these terms are generally associated with age, when describing rivers they identify the development of the area surrounding the water.




Young rivers are found in mountains where the terrain slopes steeply. As the river flows downslope, the fast-flowing water primarily erodes the river bottom and literally cuts into the mountainside and carries away the sediment. The result is a V-shaped river channel. Eventually the V-shaped river channel will become a V-shaped valley. The speed of flow enables the young river to move a range of sediment, from clay to boulders. Rapids are common in young rivers due to the slope and speed of the river flow.

Young rivers have lots of energy due to the speed of the flow on the steep mountain tops. Once the river gets to the base of the mountain, they lose energy and can no longer move sediment effectively. These sediments accumulate in a fan shape at the base of the mountain. This depositional feature is called an alluvial fan.

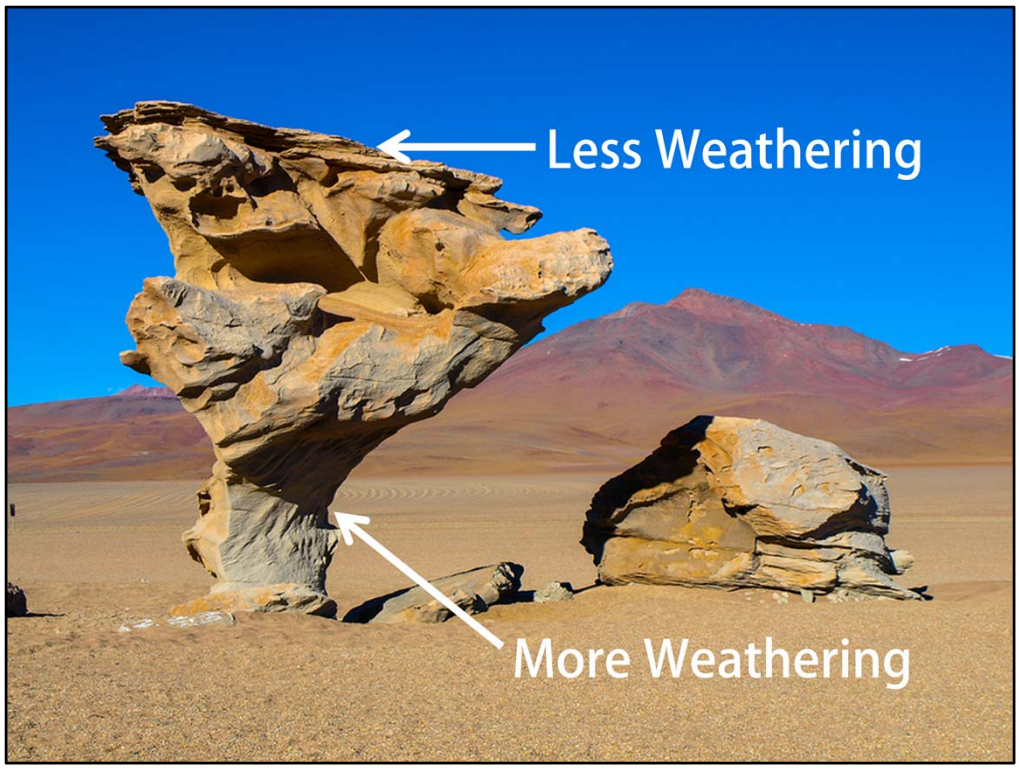

Mature rivers are found in areas characterized by hills. The terrain causes the rivers to flow a bit slower than a young river, resulting in less erosive energy. When the river erosion occurs on the river bottom, the erosion also impacts the sides of the river. This creates bends in the rivers that are called meanders.


The third and final stage of development is the old river. An old river is found on flat terrain. As a result, the river flows very slowly. Most of the erosive energy is focused on the river sides. This causes extensive meandering and the formation of oxbow lakes. Oxbow lakes are meanders that have been cut off from the flow of water as the river changes courses over time.

Old rivers are characterized by a few notable features. Old rivers have a very wide floodplain. This is the flat area next to the river where the land is broad and flat. Every time the river floods, it will carry both excess water and fine sediment. This fine sediment collects on the floodplain to create a very fertile landscape preferred by farmers for their crops. Every floodplain is at risk for experiencing a flood.

As old rivers empty into a larger still body of water, they will drop off the sediments that they are carrying. This creates a delta. Deltas are triangular deposits of sediments. The image shows the Nile River Delta. This depositional feature is large enough to be viewed from space.

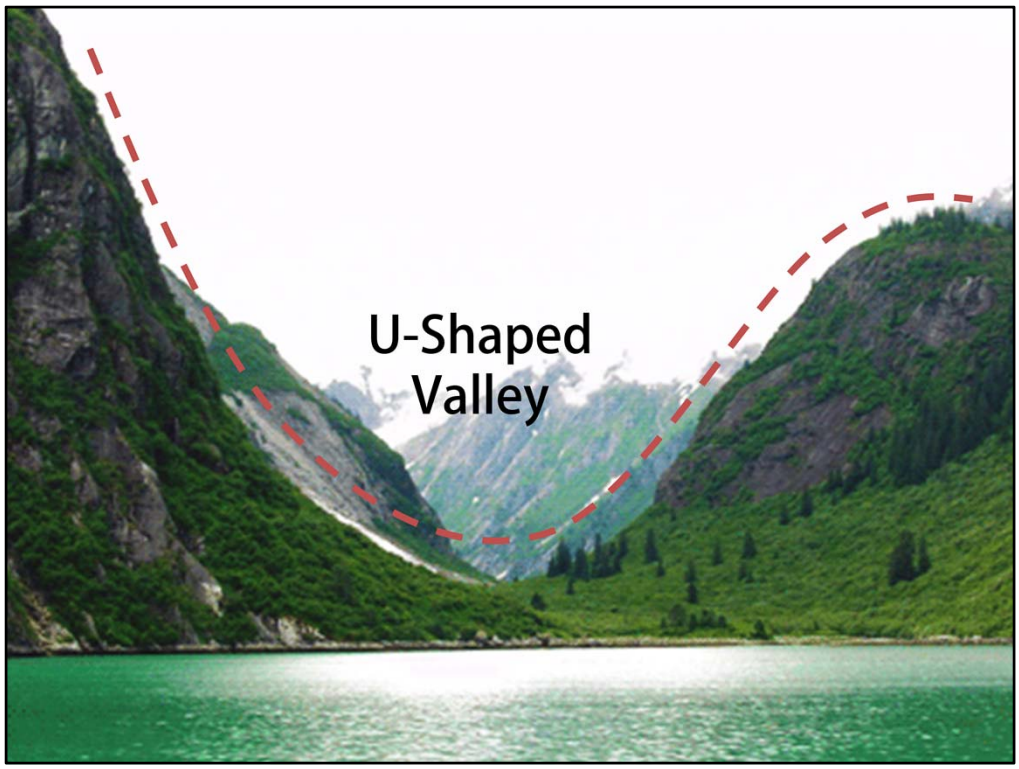
Wind is a natural phenomenon of weather that varies in speed and strength from one moment to the next. Wind is capable of picking up sediment and carrying it to other locations. The speed of the wind will determine the size of the sediments that are picked up. A gentle breeze may only pick up fine dust, but stronger winds can move sand grains and even larger pebbles. Wind erosion is most common in dry land without vegetation.




Wind has the unique ability to sculpt rock with the help of wind abrasion, a method of physical weathering. Notice the picture of the rock exposed in the desert. The base of the rock has been weathered and eroded by wind most notably at the base, where larger sediments are barely picked up by the wind.

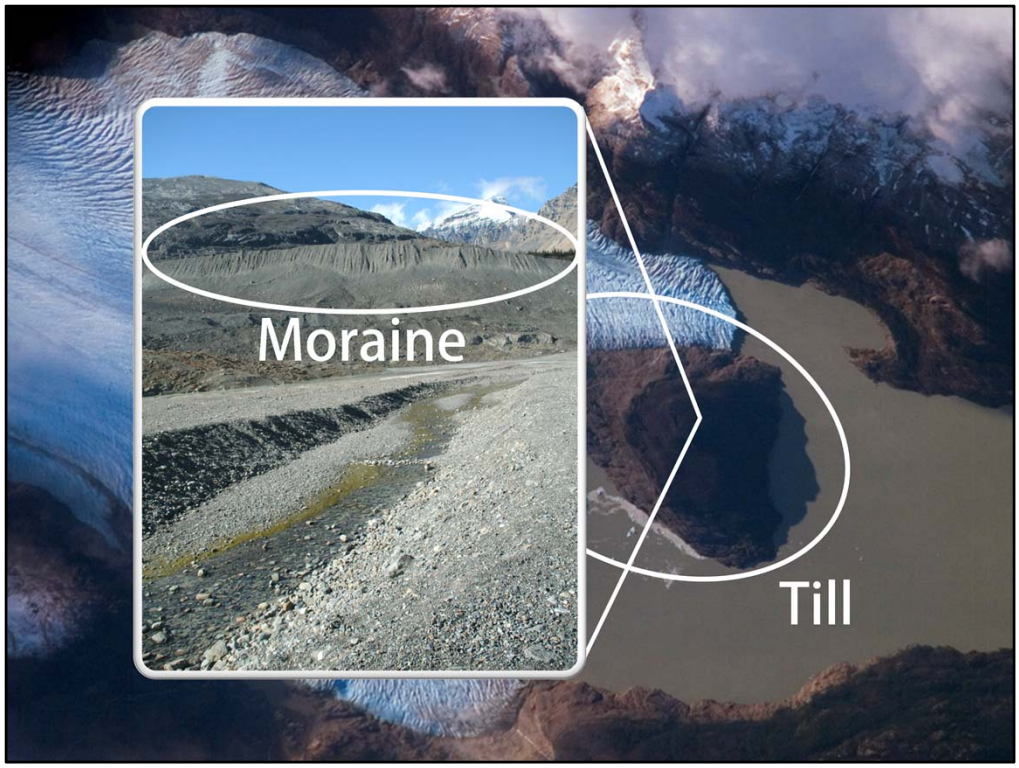

The most common deposits that form as a result of wind erosion are dunes. Dunes are hills of windblown sand. They typically form in hot and dry climates like beaches and deserts. Getting an accurate map of the desert is very difficult. Dunes are constantly moving and changing as the wind blows. Notice the dune shape and the direction of the wind. This dune is slowly moving to the right.

Glaciers are masses of ice that flow on the surface of the Earth. They form when repeated snowfalls accumulate and then pack into ice. Resembling massive frozen rivers, glaciers are capable of moving tremendous amounts of rock and sediment. In the process, glaciers create new landscapes and landforms.




After a glacier has retreated, it leaves behind a U-shaped valley. Think of a glacier like a giant bulldozer. As the ice advances, it picks up and moves everything in its path. Have you ever dropped a piece of ice on the floor? You certainly would not pick the ice back up and put it in your drink. This ice instantly picks up dirt through cohesion. Cohesion is the process of particles sticking together. With glaciers, sediments stick to the bottom and the sides of a glacier. This gives the glacier the power to carve a U-shaped valley out of a mountain region.


Now imagine a large slab of ice picking up dirt and large rocks scraping against a mountain. What kind of features do you think would form? This rock scrapes and grinds against the mountain rocks, creating large grooves. These grooves are called striations. Generally, striations are parallel to one another and indicate the direction of the advancing glacier.




If a glacier acts like a giant bulldozer, what happens to all of the debris it is pushing when it finally begins to retreat? The debris is left in a giant pile called till. Till, a depositional feature of a glacier, is unsorted rock debris and sediment that is carried and dropped. The sediment sizes in a till deposit can vary from clay particles to boulder-sized rocks. You can view the large pile of till in the image. If you were to view the till up close, you would find a very large pile of sediments, rocks, and other debris. This large pile, called a moraine, can occur at the end or on the sides of glaciers.

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Also called mass movements, erosion by gravity occurs when sediment, or other Earth materials, moves down a slope. This movement can happen very slowly, or without warning. Erosion by gravity often results in damage to structures built on the surface. Other erosional forces, like wind, water, and glaciers, can help to cause mass movements.

Mass movements can happen three ways. Sometimes, material just gradually slides down a slope. This is known as slump. An even slower mass movement is creep. Very slowly, sediments will move down a slope because of gravity. Normally, areas of creep are identified by leaning trees or telephone poles. The fastest mass movements are called debris flows. These include landslides, rockslides, and mudflows. Debris flows happen very quickly and usually without warning. No matter the speed of the mass movement, the results are the same. Sediments are displaced by gravity.