Teacher Background

What are weathering and erosion?

Weathering and erosion can ƨǑǑdzℕ Ⅰ·fϒƨăű Ⅰ·yêǿKŜℕŜ ƨy˜9Ⅰ·ℕǔKΩă ădzℕ₣Ⅰ·ǑŜ℗ They are responsible for shaping landforms that we see on the surface - from the highest mountains to the rugged canyons to the flat plains. Most landforms get their shapes, in large part, due to weathering and erosion.

Types of weathering

² ŜⅠ·ǘKŜℕƛyƎ ƛă ǘKŜ ōℕŜⅠ·ƫƛyƎ Ⅰ·LJⅠ·ℕǔ 2₮ ℕ2Ǒƫă ǘKⅠ·ú Ⅰ·ℕŝ ŜÈLJ2ăŜŘ Ⅰ·ú 9Ⅰ·ℕǔKΩă ădzℕ₣Ⅰ·ǑŜ℗ w2Ǒƫă ǑⅠ·yƴ2ǔ ōŜ ǿŜⅠ·ǘKŜℕŜŘ dzyfŜăă ǘKŜè Ⅰ·ℕŝ Ⅰ·ú 9Ⅰ·ℕǔKΩă ădzℕ₣Ⅰ·ǑŜ Ⅰ·yŘ ŜÈLJ2ăŜŘ ǘ2 ǘKŜ KèŘℕ2ăLJKŜℕŜΣ ōƛ2ăLJKŜℕŜΣ Ⅰ·yŘ atmosphere. Weathering can break down rocks into fragments of varying sizes. Weathering is also responsible for the formation of sedimentary rocks. The process of weathering creates the sediments needed to form these rocks.

Weathering can take place in a variety of ways, which are classified into two main groups: physical and chemical weathering. Physical Weathering is the physical or mechanical break up of rocks into smaller pieces without changing their chemical makeup. The main types of physical weathering are:

Biological: Would you believe that some plants are stronger than rocks?! LΩă true! When a ǘℕŜŜΩă ℕ22ǘă ∃ℕ2ǿ Ř2ǿy˜ƴyű2 ǘKŜ ǑℕⅠ·Ǒƫă 2₮ ℕ2ǑƫăΣ Ⅰ·ă ǘKŜ ǘℕŜŜ and its roots grow, they break apart the rock.

Freeze/Thaw: When water seeps into cracks and then freezes, it expands. This expansion of the ice is strong

Water

Water is responsible for the majority of weathering, erosion, and transportation of sediments on Earth. Erosion from liquid water occurs from moving water on

Wind

Under certain conditions, strong winds are also responsible for moving a substantial amount of sediments. Wind can erode in two main ways. First, when wind is strong enough, it will pick up and carry very fine particles (fine sands ς silt). This material is then moved for some distance before being dropped. Sand dunes are the result of continual movement and deposition of this wind-blown material. Dunes get their unique shape due to the direction in which the material is being moved, where one side is more steeply sloped than the other side. The wind is generally blowing from the gentle side towards the steep side.

The second way in which wind will erode material occurs when fine sediment that is being carried by the wind hits and abrades another rock or surface. The particles collide with a rock or surface and will eventually break apart that surface. This process essentially sand blasts the rock or surface and slowly breaks it apart.

Gravity

Gravity is responsible for moving sediment down a slope. Erosion due to gravity is also called mass wasting. The downhill movement of material can occur on various scales. A large, fast movement of material down a slope is called a landslide (when it occurs on unconsolidated sediments) or an avalanche (if it is from bedrock). Sediment can also move on a much slower timescale. This process is called creep or slump. Creeping of sediment is not always noticeable. However, you may notice small cracks or scrapes in the ground as well as movement of man-made structures - like a fence that is no longer straight. The highest angle a material can achieve while maintaining its stability is called the angle of repose. Different sediments will have a different angle of repose. For example, large angular gravel has a much higher angle of repose than sand-sized sediments. This is why you may see slopes along the edges of man-made structures covered in gravel or rock debris. Angular gravel has an angle of repose of around 45^{o}; whereas dry, fine sand has an angle of repose of around 30^{o}. Erosion of a slope (i.e., undercutting) can cause the slope to reach an angle that exceeds the material□s angle of repose, which will lead to slope failure and mass wasting.

Human Impacts

For the most part, humans cannot stop erosion from occurring, but we do have some control over where and how fast it occurs in regards to protecting structures. Humans can also damage ecosystems which may then lead to an increase in erosion. An example of damage would be humans walking across a sand dune at the beach and damaging the delicate sea grasses that grow. The roots of the grass add more structure to the sand and help hold the dune together. When grass is damaged and dies, these roots no longer hold the sediment, causing an increase in the amount of erosion that takes place. Displacing vegetation from deforestation, construction or farming is a large contributor to increasing erosion. Studies have shown that erosion rates in some areas have increased by a factor of 100 due to human activity.

There are several

Station 2: Wind

Materials:

1. Aluminum roasting pans (one side missing)
2. Sand, silt, and pebbles mixture
3. Hair Dryer
4. Cup

Procedure:

1. Read the information card(s) about wind erosion.

2. Have students take one roasting pan and a hairdrwsting

Station 3: Ice Erosion

Night Before: In one ice cube tray, place only water and set in freezer overnight. In a second ice cube tray, place a little bit of sand in each well and then fill with water and set in the freezer overnight.

Materials:

1. Ice Cube tray with ice cubes pre-frozen.
2. Modelling clay
3. Rolling pin
4. Placemat

Procedure:

1. Have the students take a fist full of modelling clay and kneed it to make rolling easier.
2. On the placemat the student should roll out their clay about ¼ in thick.
3. Have the student take an ice cube from the tray with no sediment.
4. The student can then pretend the ice cube is a glacier and rub the ice cube back and forth on the modelling clay. Teacher Note: Students should see not much change in the clay, it may get smooth as the ice melts and wets the clay. Students should stop before the clay gets excessively wet.
5. They should write their observations in their journal.
6. Next the students can take an ice cube that contains sediment.
7. Again, have them pretend the ice cube is a glacier and rub the ice cube across the modelling clay. Teacher Note: Students should see that the ice with sand embedded in it will dig into and leave scratch marks across the clay.
8. The students should compare their clay to provided pictures of glacial striations.
9. Have the student write their observations in their journal.
10. Students can then compare their model to pictures and examples of glacial striations. They can write about their observations in their journal.