

4th Grade Earth Science Processes that Shape the Earth

Teacher Background Information – for teacher content knowledge only, NOT student learning goals

There are forces both deep inside the earth and on the earth's surface that continually work to reshape the features of the landscape. These natural actions include earthquakes, volcanoes, wind, water, and shifting plates under the earth's surface. To understand how these affect the earth's surface it is important to consider the properties of matter such as when water freezes it expands and cracks rocks. Gravity also plays an essential role in erosion and deposition as rivers and ice carry rocks and sediments downstream. Sometimes these changes can happen fast through dramatic shifts from earthquakes or floods or occur slowly over geologic time with the build up of a variety of deposited landforms such as beaches, dunes, moraines, and alluvial fans. Mountains are also formed from the uplift of land, including areas that were once part of oceans. Through this process, fossils are elevated along with the rock in which they were formed. Today the processes of weathering and erosion expose fossils in the rock that were formed a million of years ago.

Instructional Implications

Focus should not be on classification but on observable features. Students should spend time observing features of rocks, sands, and soils with hand lenses. Students should develop explanations to describe phenomena based on their observations. Students should not classify rigorously, but instead notice the variety of components in rocks.

Children should have opportunities to observe rapid and gradual changes and can do so through outdoor observations and stream table simulations. At this time they can also start recognizing the impact of human development on the land.

The origin of rocks and minerals has little meaning to young children.

Along with erosion, transport, and deposition, students should spend some time on the exploration of volcanic and earthquake activity. This can occur through film and research. It is important to work toward the science based on the student interest. Be explicit about geologic time and recognize that students may still not understand it.

Big Idea

The surface of the earth is constantly changing and no feature on earth is permanent.

Essential Questions

What are the natural causes that create rapid or slow change on the surface of the Earth?

How do these natural causes affect the Earth's surface?

AAAS Benchmarks/National and Science Education Standards

Processes that Shape the Earth

- Things change in steady, repetitive, or erratic ways—or sometimes in more than one way at the same time. 11C/E2
- How fast things move differs greatly. Some things are so slow that their journey takes a long time; 4F/E2 (First part also listed under Physical Science)
- Waves, wind, water, and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers. 4C/E1
- Rock is composed of different combinations of minerals. Smaller rocks come from the breakage and weathering of bedrock and larger rocks. Soil is made partly from weathered rock, partly from plant remains—and also contains many living organisms. 4C/E2
- Fossils provide evidence about plants and animals that lived along time ago and the nature of the environment at that time.
- Things on or near the earth are pulled toward it by the earth's gravity. 4B/E1

Local Connections

The Mendenhall Glacier provides a firsthand look at the earth's changing features. Any of our local streams provide an opportunity to see natural and human caused erosion. The effects of slides are present on the Flume Trail and other steep areas. These are dramatic examples of erosion.

Dr. Cathy Connor at UAS

Materials/Resources

- STC kit: Land and Water
- Nat. Geo. Theme Set: Shaping Earth's Surface
- Picture Perfect Science 3-6: Grand Canyon; Ch. 19,
- Sealaska Heritage Series: Earth & Rocks
- Bill Nye Video: Fossils/Erosion

Assessments

Uncovering Student Ideas in Science

Volume 1 Probe 22: Beach Sand

Volume 1 Probe 23; Mountain Age

Volume 2 Probe 22; Mountain Top Fossil

Related Scientist or Career Path

What Can She Be?: A Geologist by Gloria and Esther Goldreich

Student Difficulties and Misconceptions

Students tend to believe that the earth is always as it is now and that changes must have been sudden. They also have a hard time understanding the notion of geologic time.

Students may confuse the growth of organisms with the growth of mountains. They may believe the tallest mountains are the oldest and not recognize the effects of erosion.

Alaska GLE's

The student demonstrates an understanding of geochemical cycles by:

[4] **SD1.1** describing that most smaller rocks come from the breaking and weathering of larger rocks as part of the rock cycle.

[4] **SD1.2** recognizing the physical properties of water as they relate to the rock cycle.

The student demonstrates an understanding of the forces that shape Earth by

[3] **SD2.1** identifying and comparing a variety of Earth's land features (i.e., rives, deltas, lakes, glaciers, mountains, valleys, and islands)

[4] **SD2.1** observing models of how waves, wind, water, and ice shape and reshape the Earth's surface by eroding rock and soil (L)

[4] **SD2.2** identifying causes (i.e., earthquakes, tsunamis, volcanoes, floods, landslides, and avalanches) of rapid changes on the surface

[5] **SD2.1** describing how wind and water tear down and build up the Earth's surface resulting in new land formations (i.e., deltas, moraines, and canyons)

[4] **SC1.2** describing fossil evidence (e.g., casts, track ways, imprints, etc.) of extinct organisms