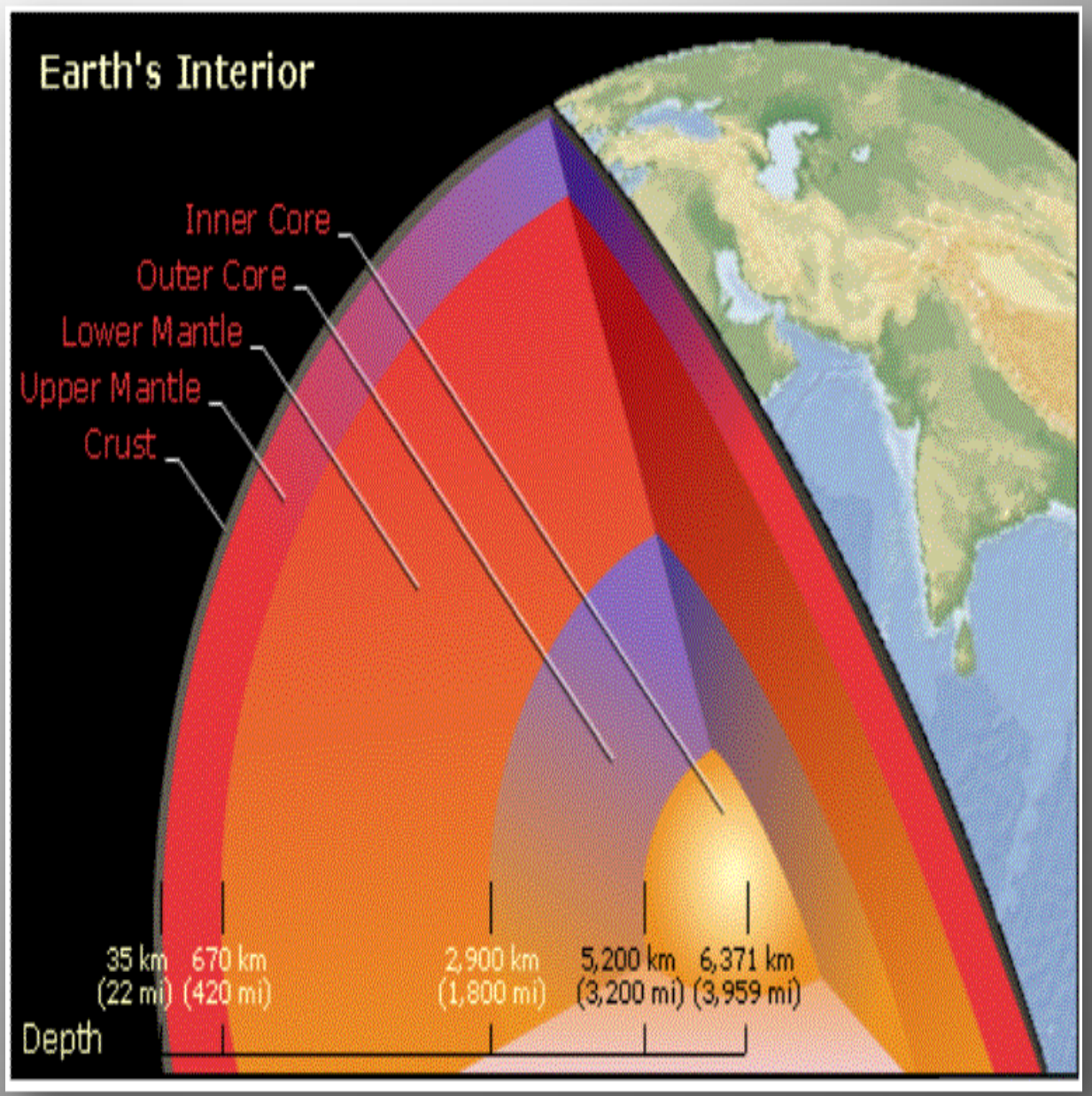
Our Changing Earth

You may know that you change a little every day. Maybe you grow a little or maybe you cut your hair. But did you know that the Earth changes every day, too?

Sometimes the Earth changes in small ways and sometimes it changes in big ways. In order to understand this phenomenon, let’s journey back in time to “The Center of the Earth.”

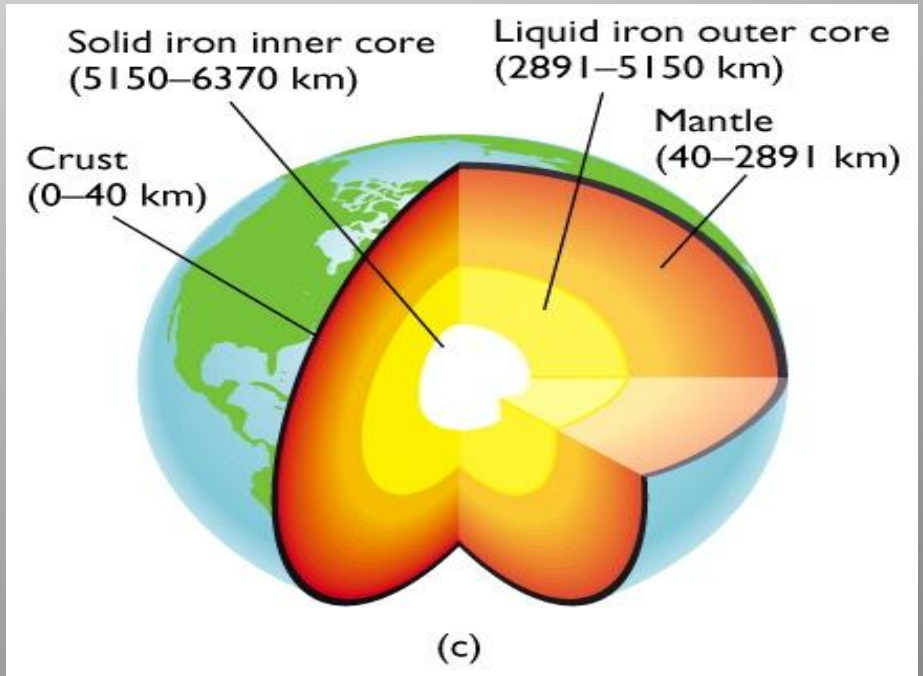
The Earth's Core

We live on the Earth's thinnest and hardest layer, called the crust. The crust is made of solid rock. Underneath the crust is the second layer, called the mantle. The mantle is a thick, soft layer of rock. Some of the rock in the mantle is melted. It moves and swirls around like warm taffy.

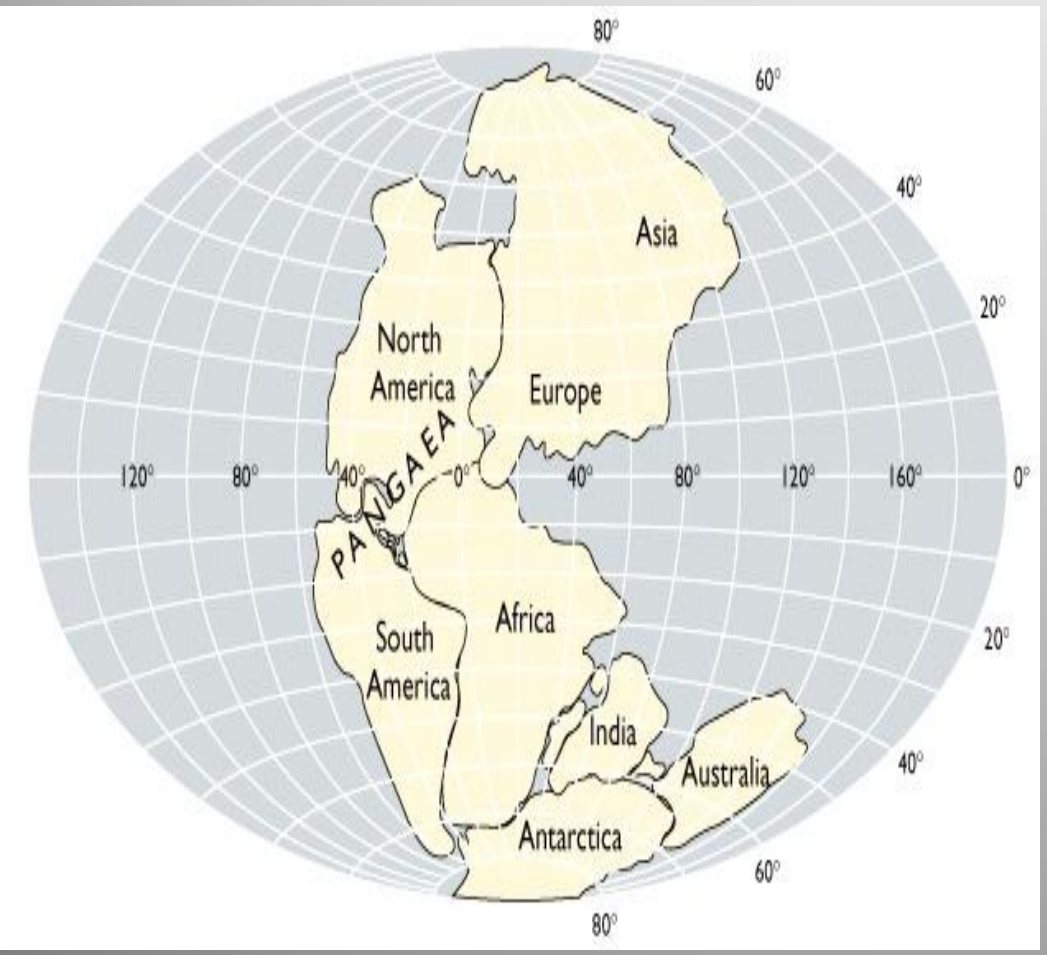


Earth's Layers

- At the center of the Earth is the third layer. It's called the core. The core is mostly solid rock and metal. Scientists think that the core is almost as hot as the surface of the sun.



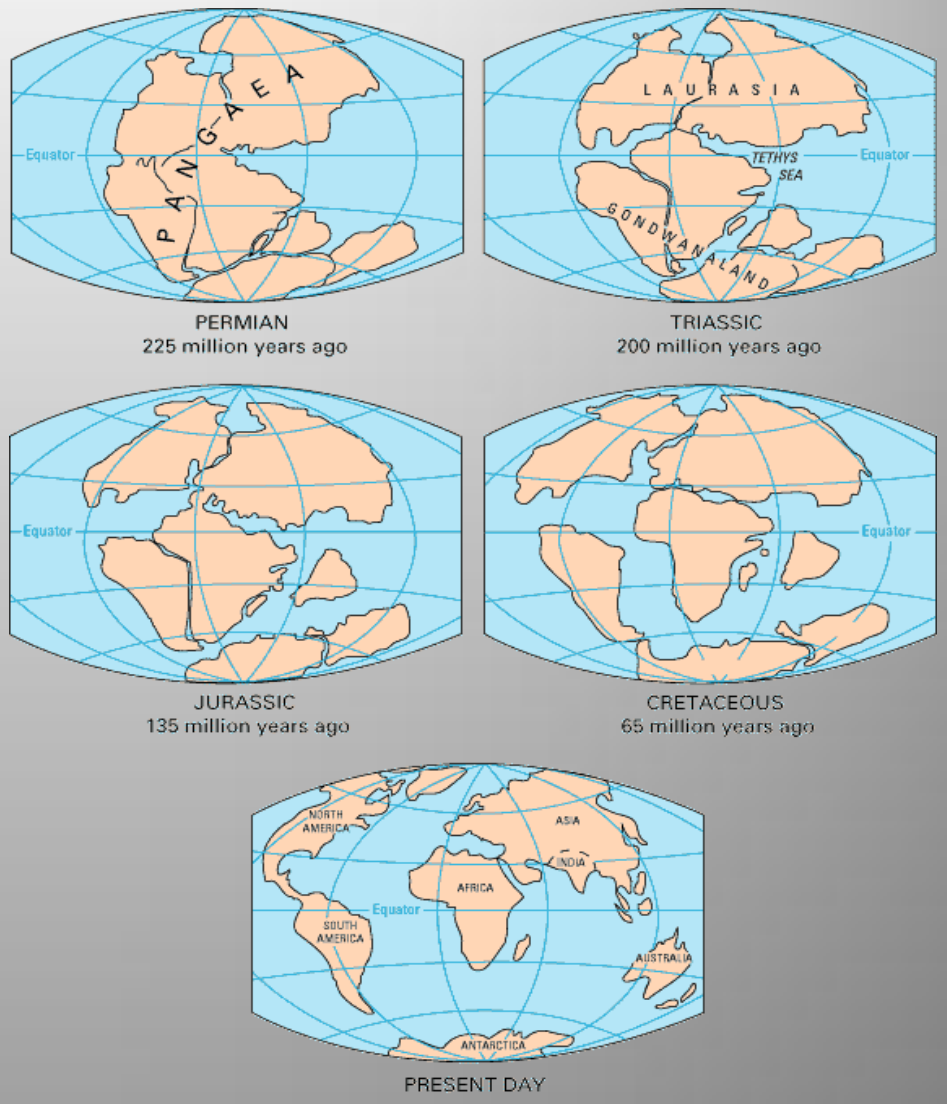
Pangea



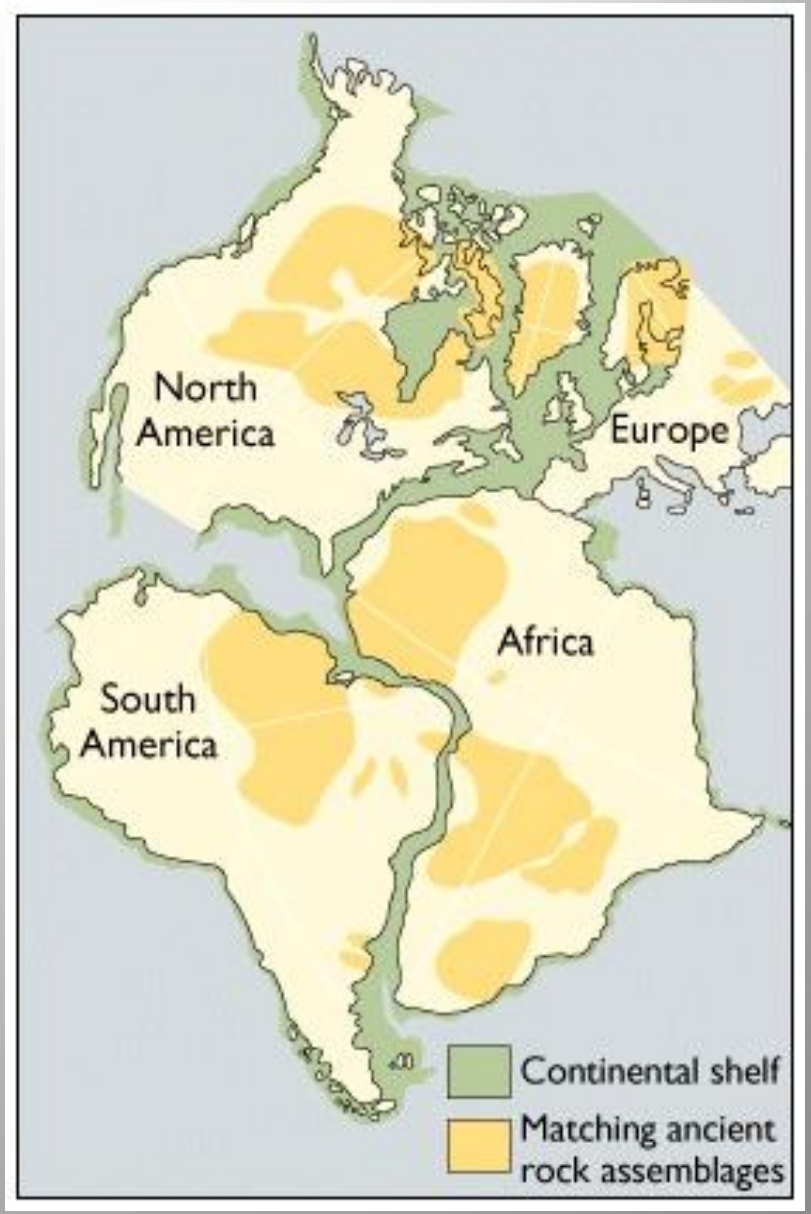
Millions of years ago when the dinosaurs were alive, the Earth looked something like this. Do you see how the continents fit together like pieces of a jigsaw puzzle?

- All the land on Earth joined together, making one huge supercontinent.

- Then the supercontinent began to split apart. Large chunks of land slowly drifted in different directions. They moved only about four inches, or about ten centimeters, a year. If your moved that slowly, it would take you almost 2,000 years to walk one city block.



- Today, the continents are still drifting very slowly. The continents and ocean floors are part of Earth's crust, which is cracked into big pieces called plates. The giant plates float and move on top of the mantle, like leaves on a pond.



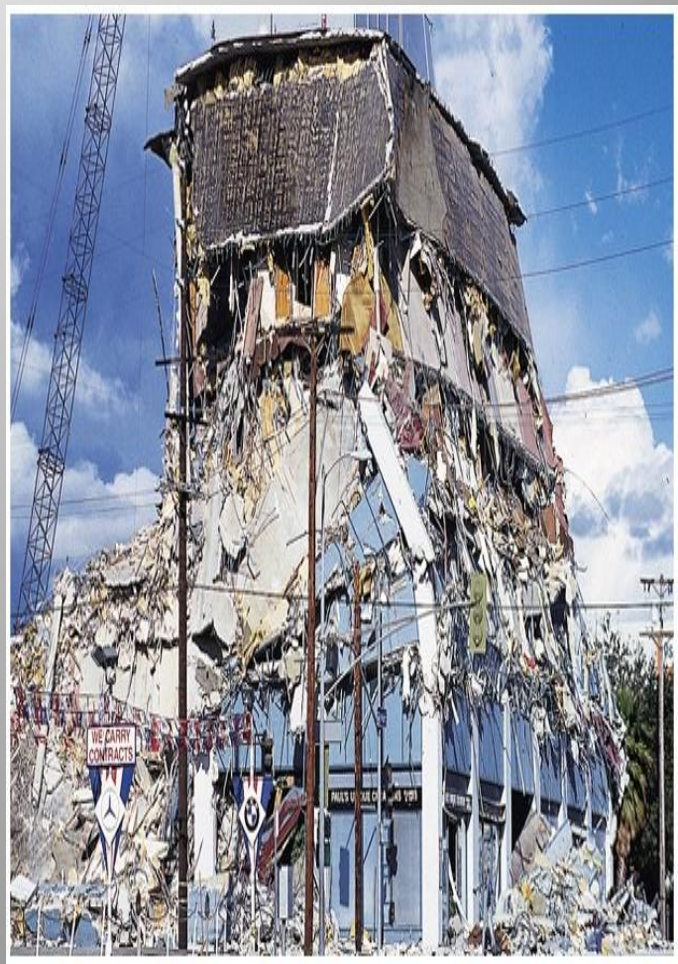
The continents and ocean floors are part of the Earth’s crust, which is cracked into big pieces called **plates** that move on top of the mantle.

Constructive Forces

Natural forces that build or construct landforms and causes changes in the Earth's surface.

Surface features caused by Constructive Process

- Deposition (deltas, sand dunes, etc.)
- Earthquakes
- Volcanoes
- Faults



Destructive Forces

Natural forces that destroy landforms and causes damaging changes in the Earth's surface.

- At other times, the Earth can change slowly. Here, an earthquake that lasted for less than a minute shook the ground violently, and buildings tumbled down.

Earthquakes:

- Shaking that results from the movement of rock (tectonic plates) beneath Earth's surface

•Destructive force or Constructive force

•Most occur because of moving crust

- Earthquakes cause vibrations across the ground, sending shock waves that crumble buildings.

Fault

Earthquakes are caused when giant plates in Earth's crust that are pressing against each other suddenly slip. Places where these plates meet are called faults. This picture shows the San Andreas Fault in California.

Stress

- Force that acts on rock to change its shape and volume

- Energy is stored in the rock until it breaks or changes shape

3 Types of Stress on Plates:

Shearing Tension Compression

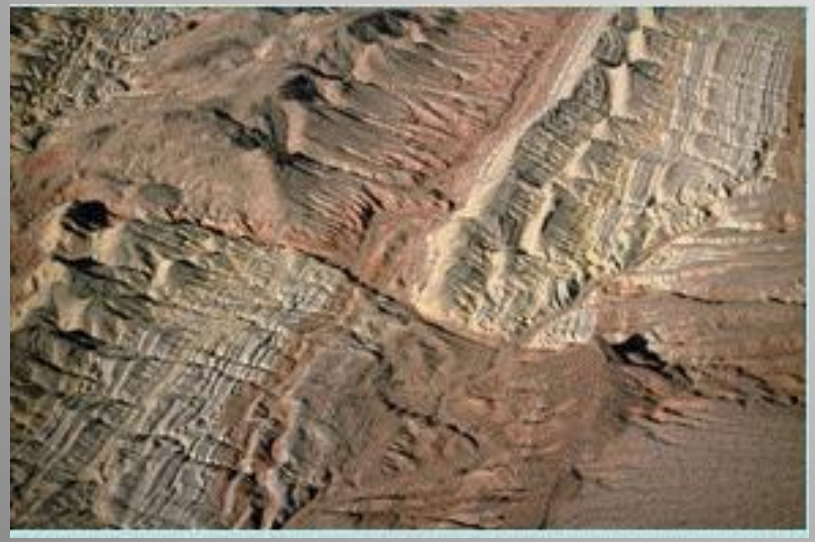
Shearing(Strike-Slip)

Shearing is when two plates slide past each other. The plates are pulled in opposite directions past each other.

→

- San Andreas (California)

←



Compression (Convergent Fault)

A convergent fault is when two plates come together. The plates are squeezed together until it folds or breaks.

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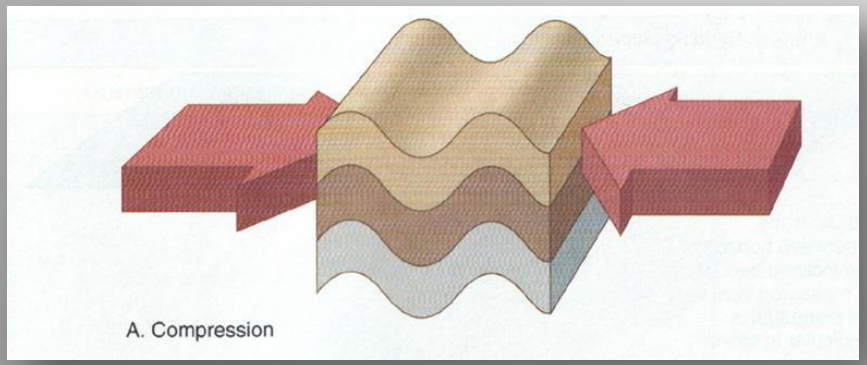
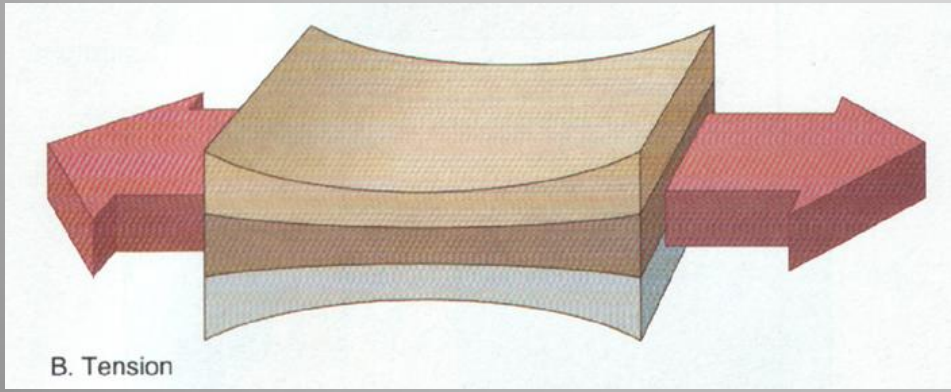


- Creates fold mountains

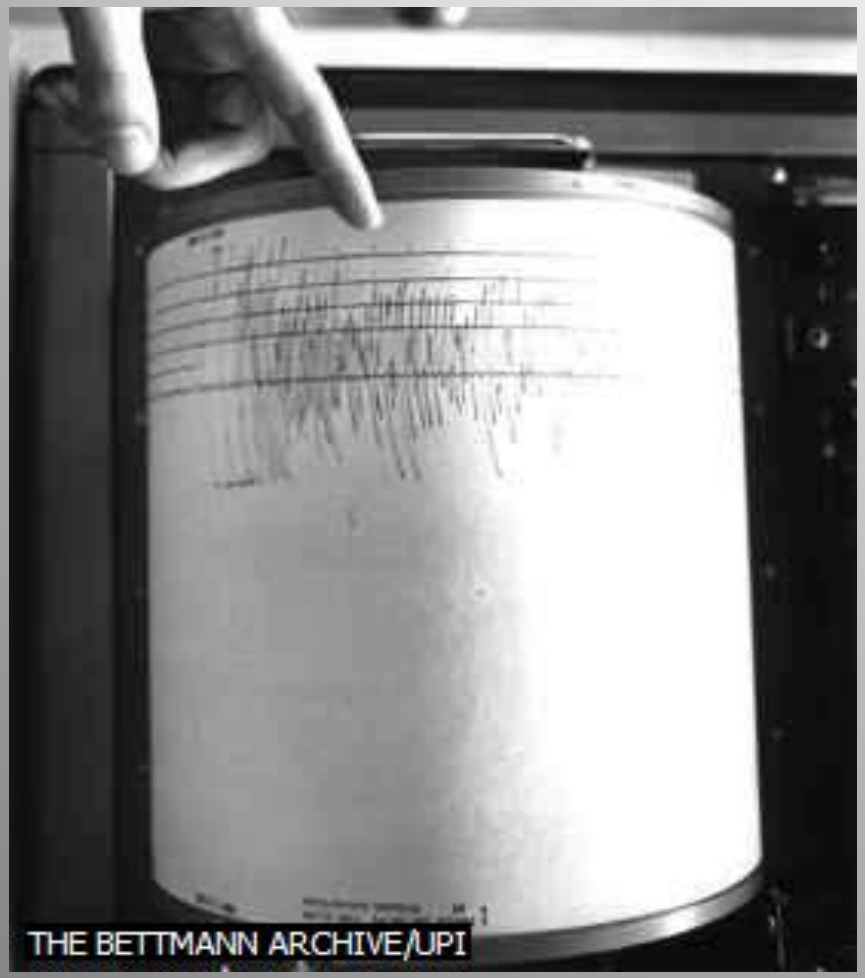
Tension (Divergent Faults)

A tension is where two plates are moving away from each other.

Rocks are stretched so that it becomes thinner in the middle.



Seismograph



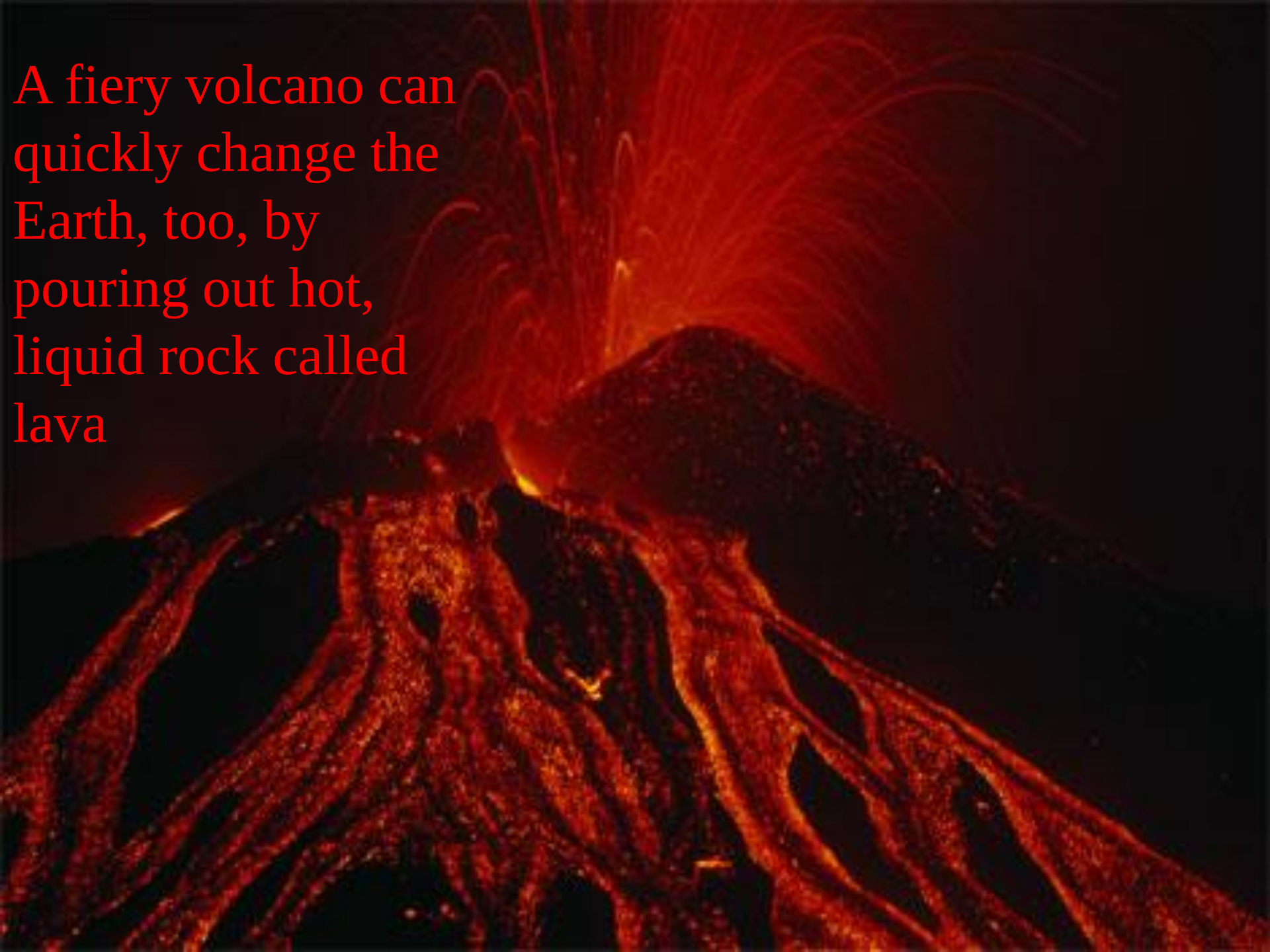
- Today, scientists use machines called seismographs to record how much the ground shakes.

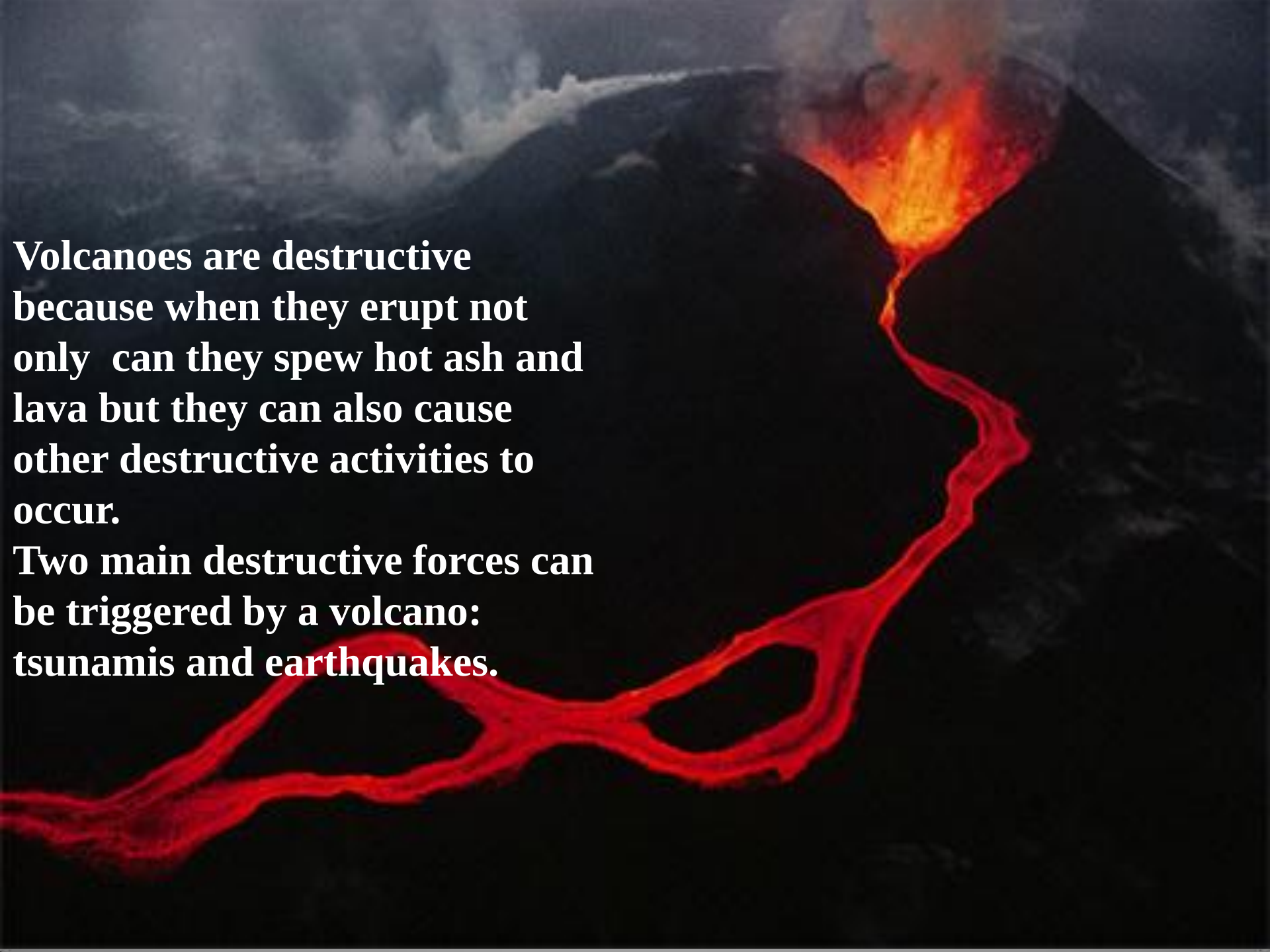
Rating Scales used for Quakes:

2. Richter – Rate quakes according to the size of the seismic waves

Value	Potential Hazard
10	Extraordinary
9	Outstanding
8	Far-reaching
7	High
6	Noteworthy
5	Intermediate
4	Moderate
3	Minor
2	Low
1	Insignificant

- low ---> high (1-9)
  -each # is 10x stronger
- humans cannot feel a quake below 2
- 6 or more = major quake
- Measures magnitude


A fiery volcano can quickly change the Earth, too, by pouring out hot, liquid rock called lava

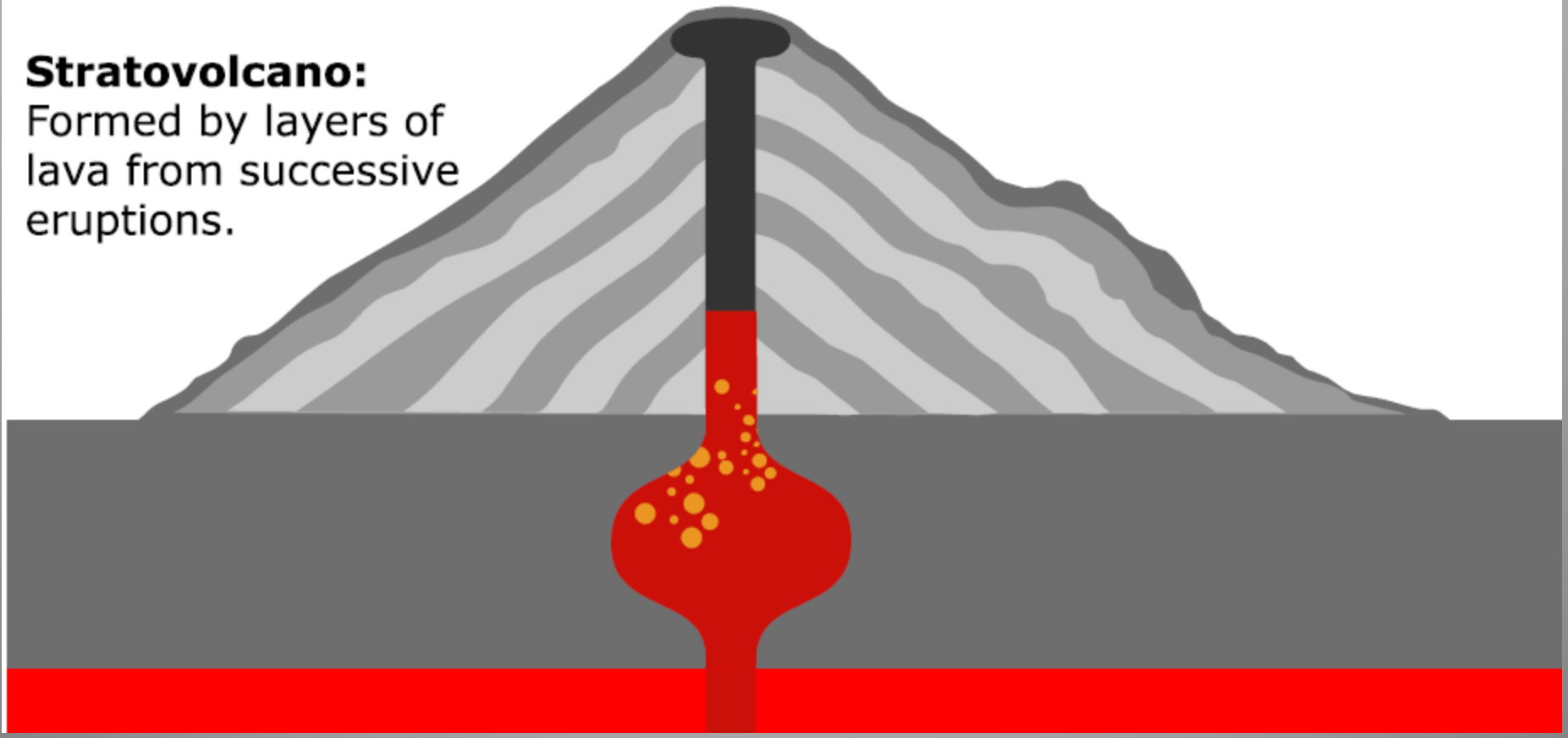


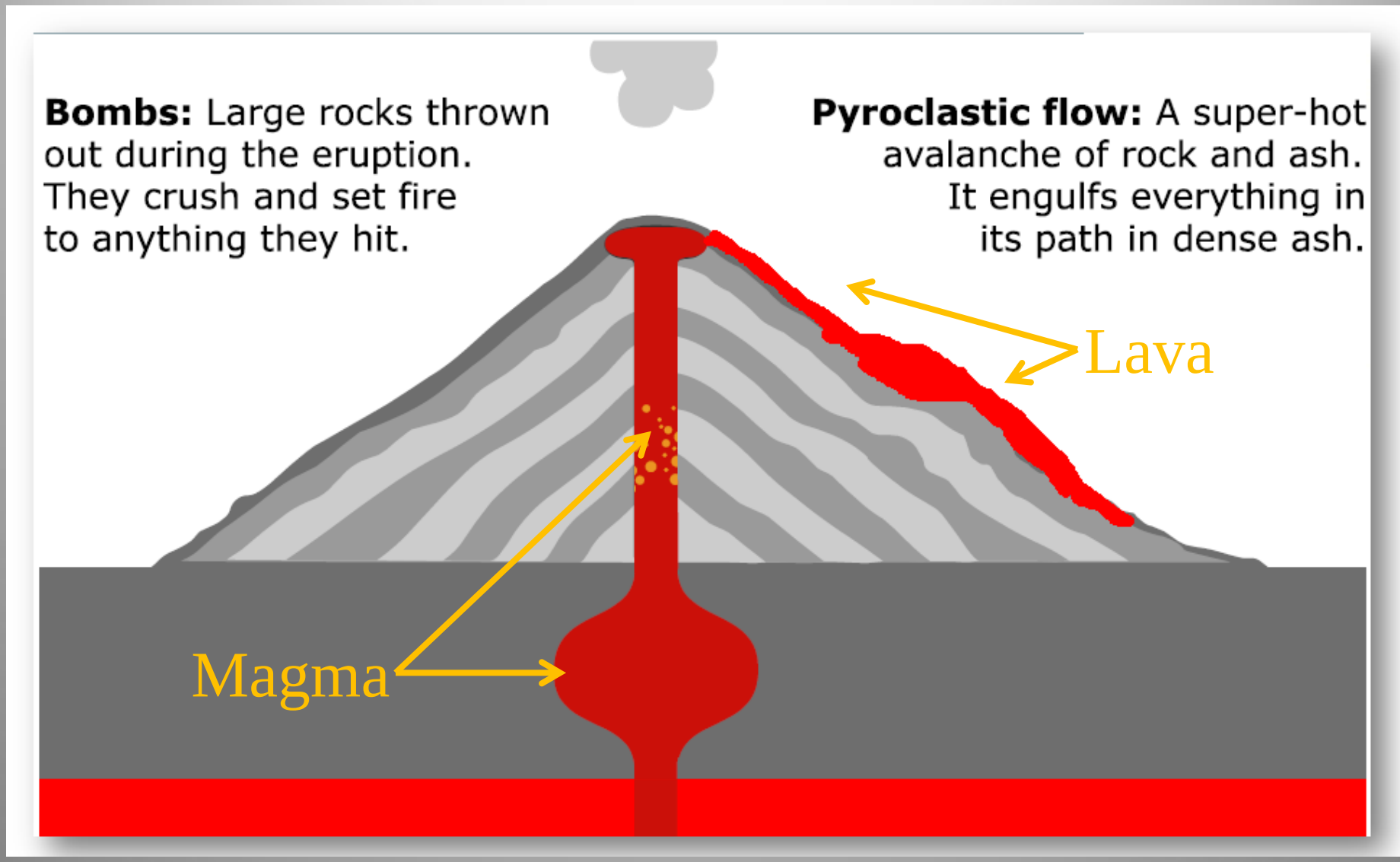
Volcanoes are destructive because when they erupt not only can they spew hot ash and lava but they can also cause other destructive activities to occur.
Two main destructive forces can be triggered by a volcano: tsunamis and earthquakes.

VOLCANOES

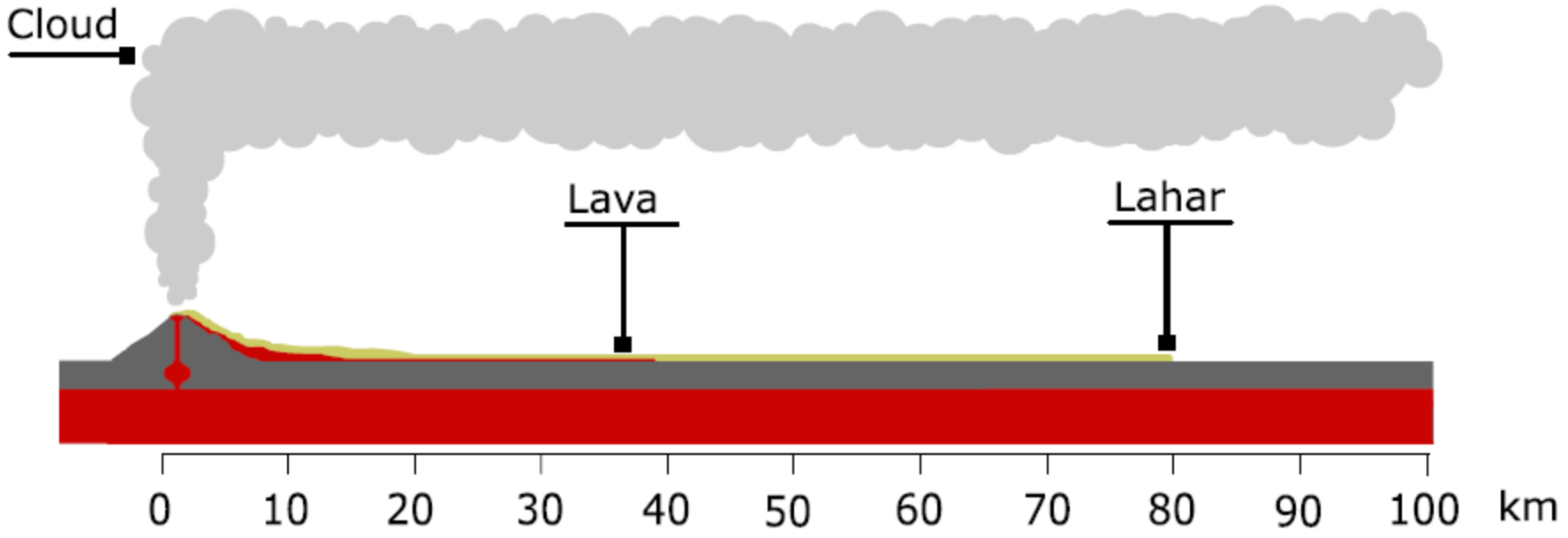
Areas along edges of plates are prone to geological upheaval. Molten rock – magma – finds its way into the upper crust. If it reaches the surface it becomes a volcano.

Stratovolcano:
Formed by layers of lava from successive eruptions.




Bombs: Large rocks thrown out during the eruption. They crush and set fire to anything they hit.
Pyroclastic flow: A super-hot avalanche of rock and ash. It engulfs everything in its path in dense ash.
Lava
Magma

Eruption Cloud: Ash and toxic gases including sulphur dioxide pollute the atmosphere over a large area and can contribute to acid rain.



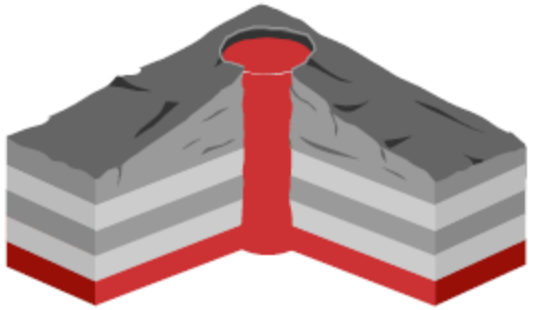
Lava: Molten rock flows slowly but is very destructive, burning anything in its path and cutting off escape routes.

Lahar: Mud flows can be swift, silent and lethal, engulfing homes many miles away from the volcano.

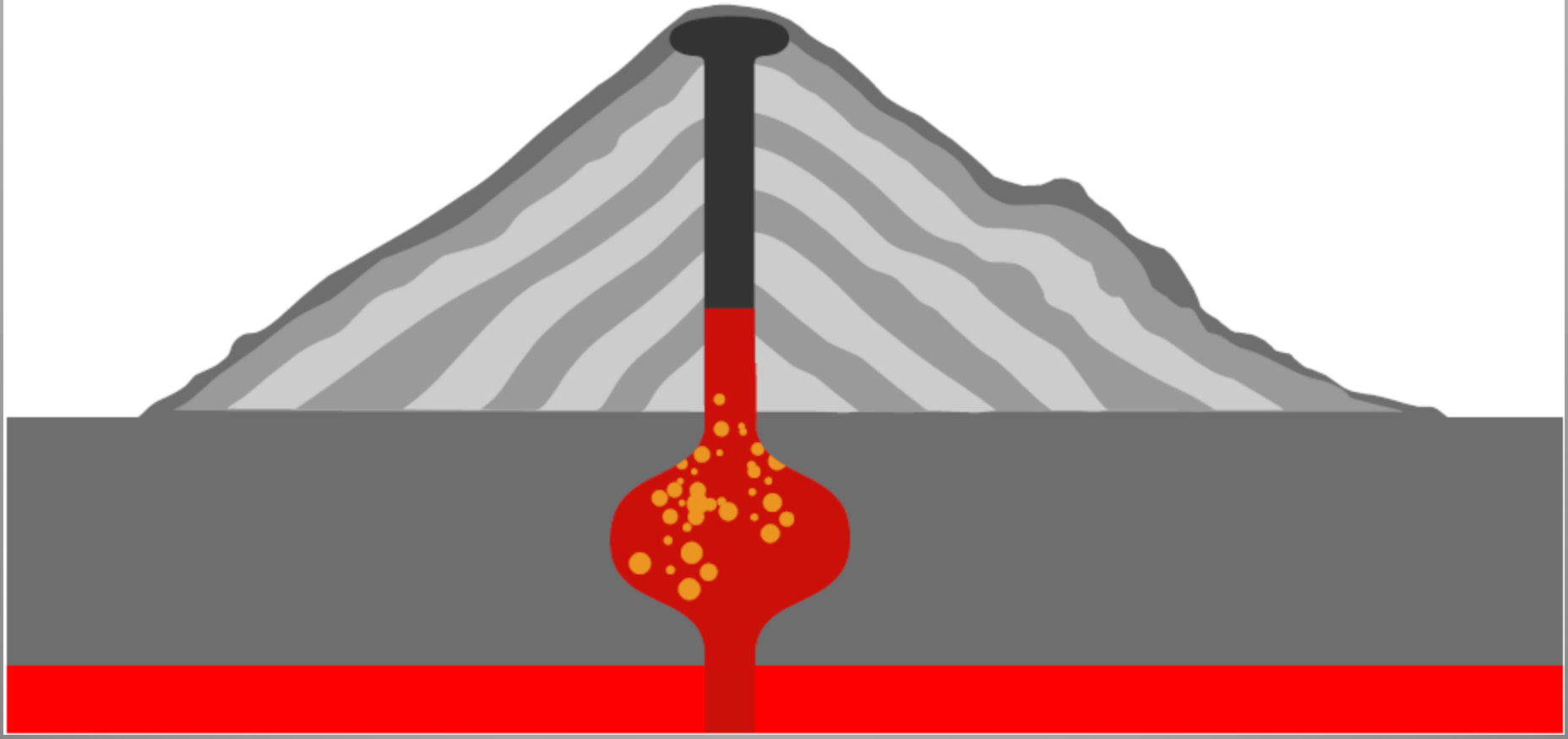
Not all active volcanoes are stratovolcanoes, other types exist.

Caldera volcanoes are formed when the dome of a strato volcano collapses, leaving a broad circular vent.

Shield volcanoes are formed by eruptions of runny basalt lava which flows swiftly and does not build up in a cone shape.



An eruption is caused by pressure of dissolved gas building up in the magma. When it becomes greater than the surface can take, the volcano erupts.



Three Types of Volcanoes

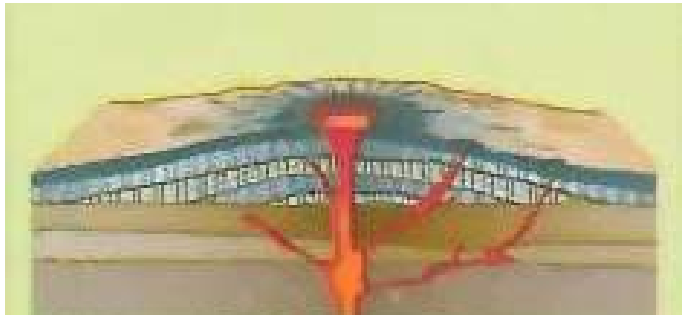
Shield Volcanoes

Composite Volcanoes

Cone Volcanoes

Shield Volcanoes

Shield volcanoes are very large in size. This type of volcano has a large slope because the lava flows over long distances. Examples of shield volcanoes the volcanoes that make up the Hawaiian chain of islands, such as Mauna Loa and Mauna Kea.



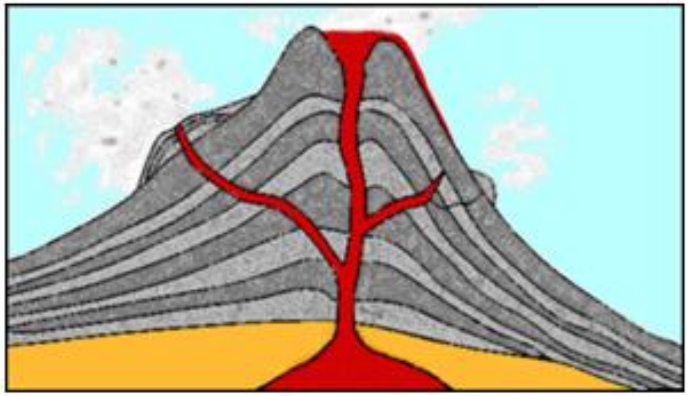
Because the volcanoes erupt with such fast flowing lava, magma doesn't build up inside, and there's very little risk of explosive eruptions.

Composite Volcanoes (Stratovolcanoes)

Stratovolcanoes form from explosive eruptions. Materials pile up around the vent to form a steep-sided volcano. Most stratovolcanoes are smaller than shield volcanoes and erupt less often. The name *stratovolcano* refers to the *strata* (layers) of pyroclasts and hardened lava that make up the volcano's cone.

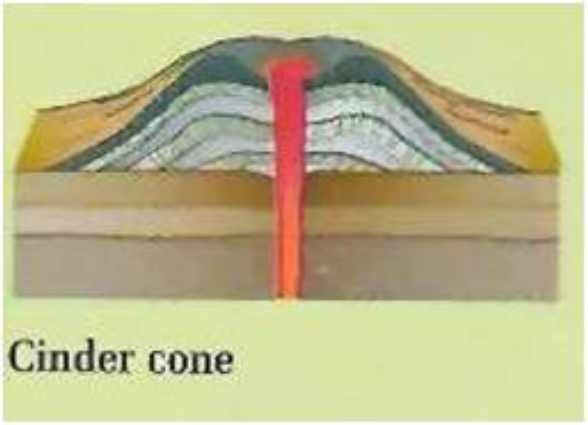
Stratovolcanoes are among the most common volcanoes on Earth.

Some of the most famous eruptions have come from composite volcanoes: Mount St. Helens, Krakatoa, and Mount Ranier. Composite volcanoes are built up over hundreds of thousands of years with many different eruptions layered on top of each other. Because the lava doesn't flow as far during an eruption, it helps to built up the volcano to great heights.

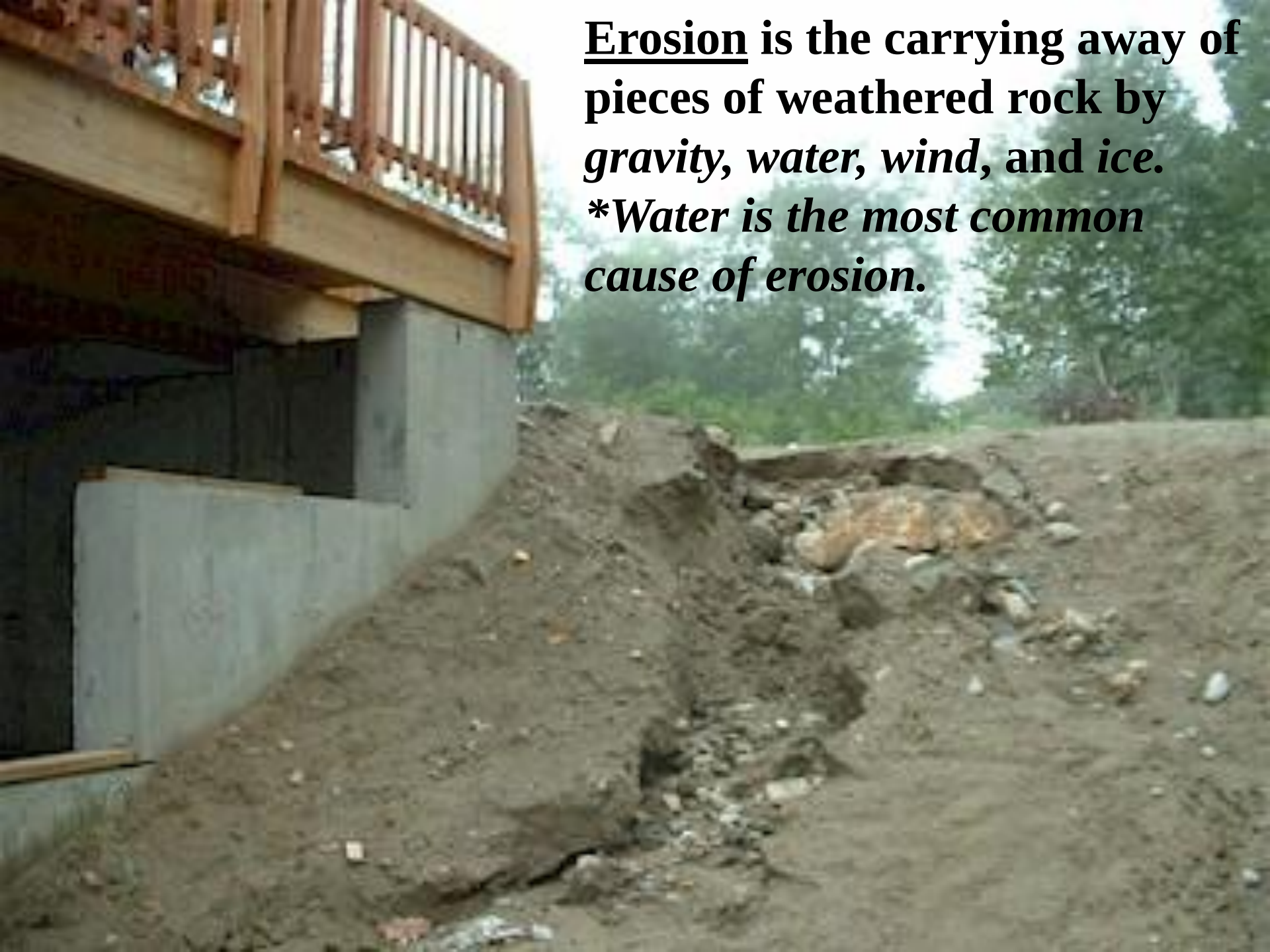


Cinder Cone Volcanoes

The classic volcano, with a sharp cone spewing out lava and rock, is a cinder cone volcano. These volcanoes can rise to a height of a few hundred meters in the span of just a few decades (or even months). The lava doesn't travel far during eruptions. Material spewed out of the volcanic vent just piles up around it, building up the steep cinder cone shape.

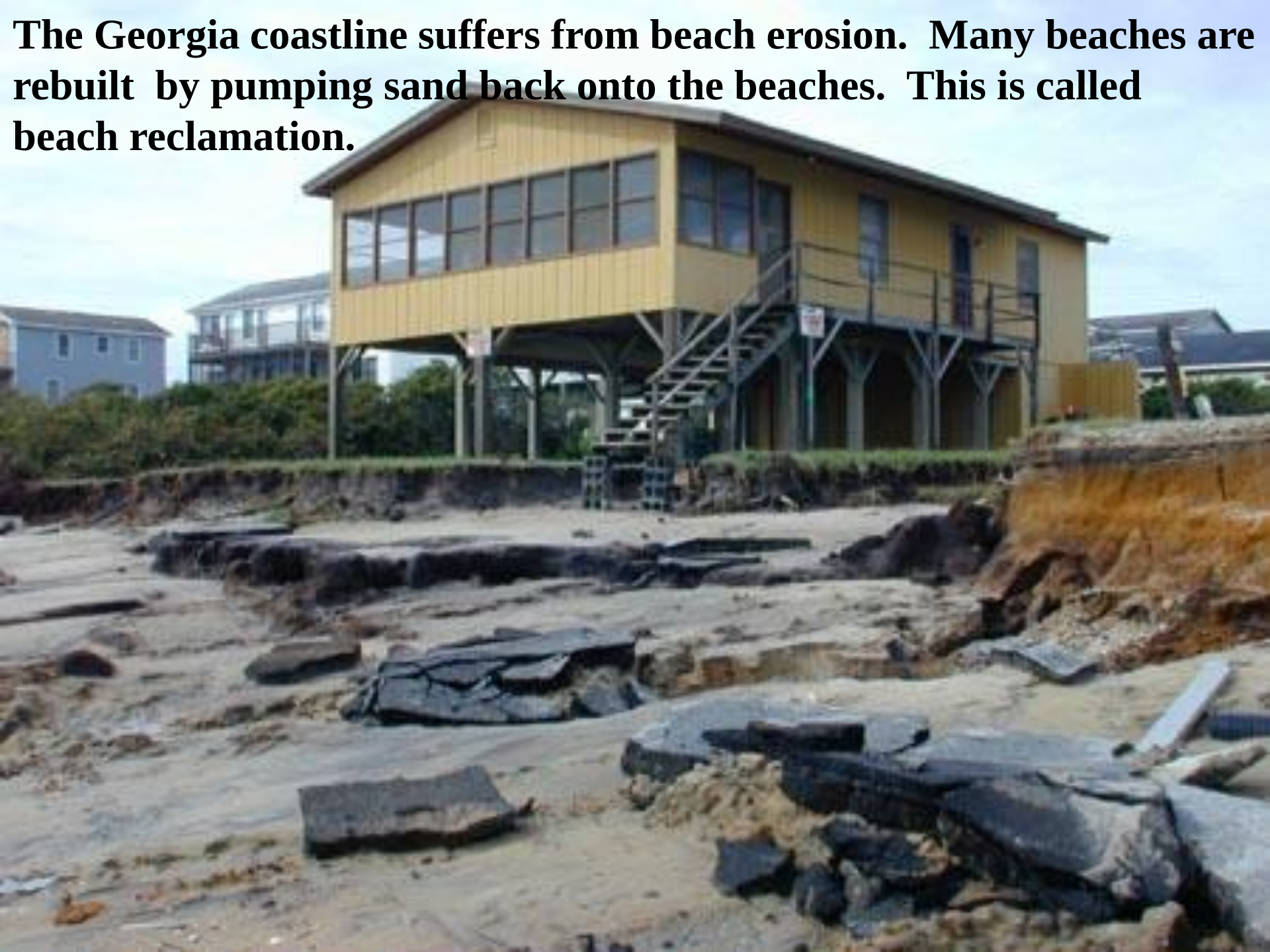


Cinder cone



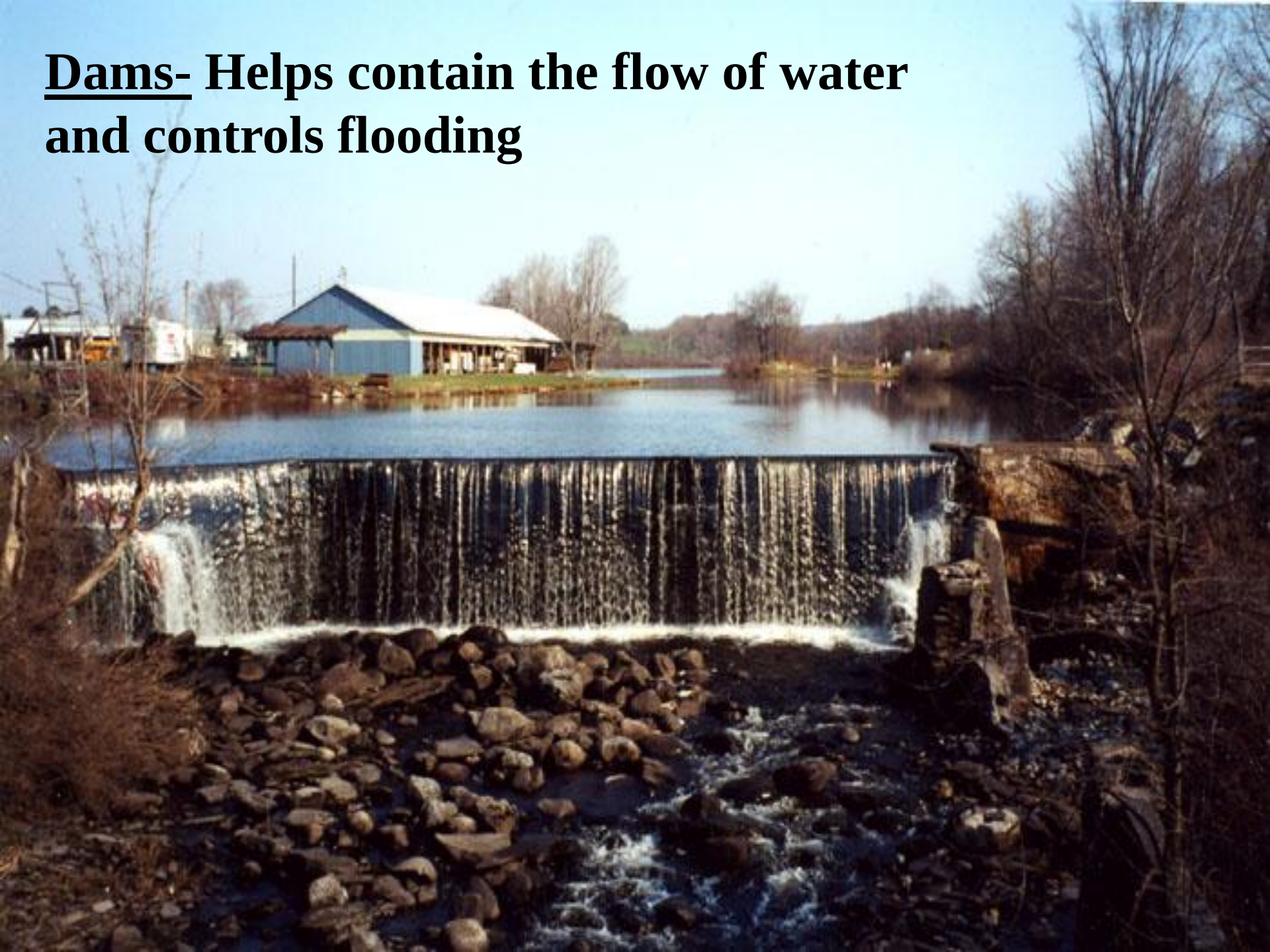
<u>Erosion</u> is the carrying away of pieces of weathered rock by *gravity, water, wind*, and *ice*.

Water is the most common cause of erosion.


The Georgia coastline suffers from beach erosion. Many beaches are rebuilt by pumping sand back onto the beaches. This is called beach reclamation.

Man made Interventions

- Dams
- Man-Made Levees
- Stone lined ditches
- Plants (grass, trees, shrubs)


Dams- Helps contain the flow of water and controls flooding

Benefits of Dams

Flood Control
Dams help prevent the loss of life and property caused by flooding. Flood control dams hold back floodwaters and then either release the water, store it, or use the water for other uses. For centuries, people have built dams to help control devastating floods.

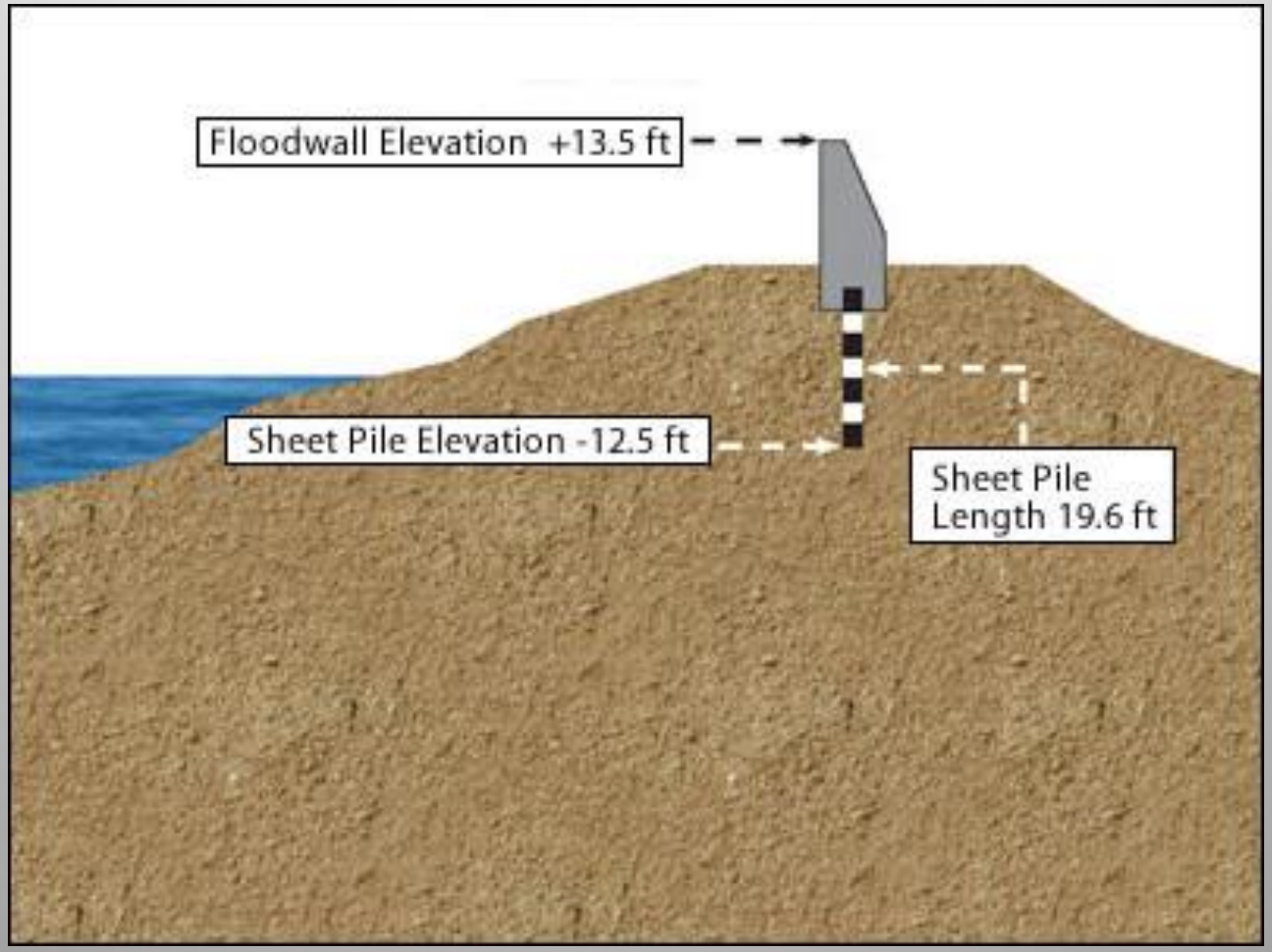
Recreation
Dams provide prime recreational facilities throughout the United States. Boating, skiing, camping, picnic areas, and boat launch facilities are all supported by dams.

Water Storage
Dams create reservoirs throughout the United States that supply water for many uses, including industrial, municipal, and agricultural.

Human constructed Levees- Help to keep the flow of water inside of the river.

•Levees are also another way to help control flooding.


Broken Levee that caused flooding and destruction during Hurricane Katrina.


Floodwall Elevation +13.5 ft
Sheet Pile Elevation -12.5 ft
Sheet Pile
Length 19.6 ft

Drainage ditches lined it with rocks help move water and prevent erosion.

Erosion can be prevented with rock piled along shorelines.

Plants are one of the best and cheapest ways to prevent erosion.

Terracing a hillside can help prevent erosion.

Contour Plowing

Crop row ridges built by tilling and/or planting on the contour create hundreds of small dams. These ridges or dams slow water flow and increase infiltration which reduces erosion. .

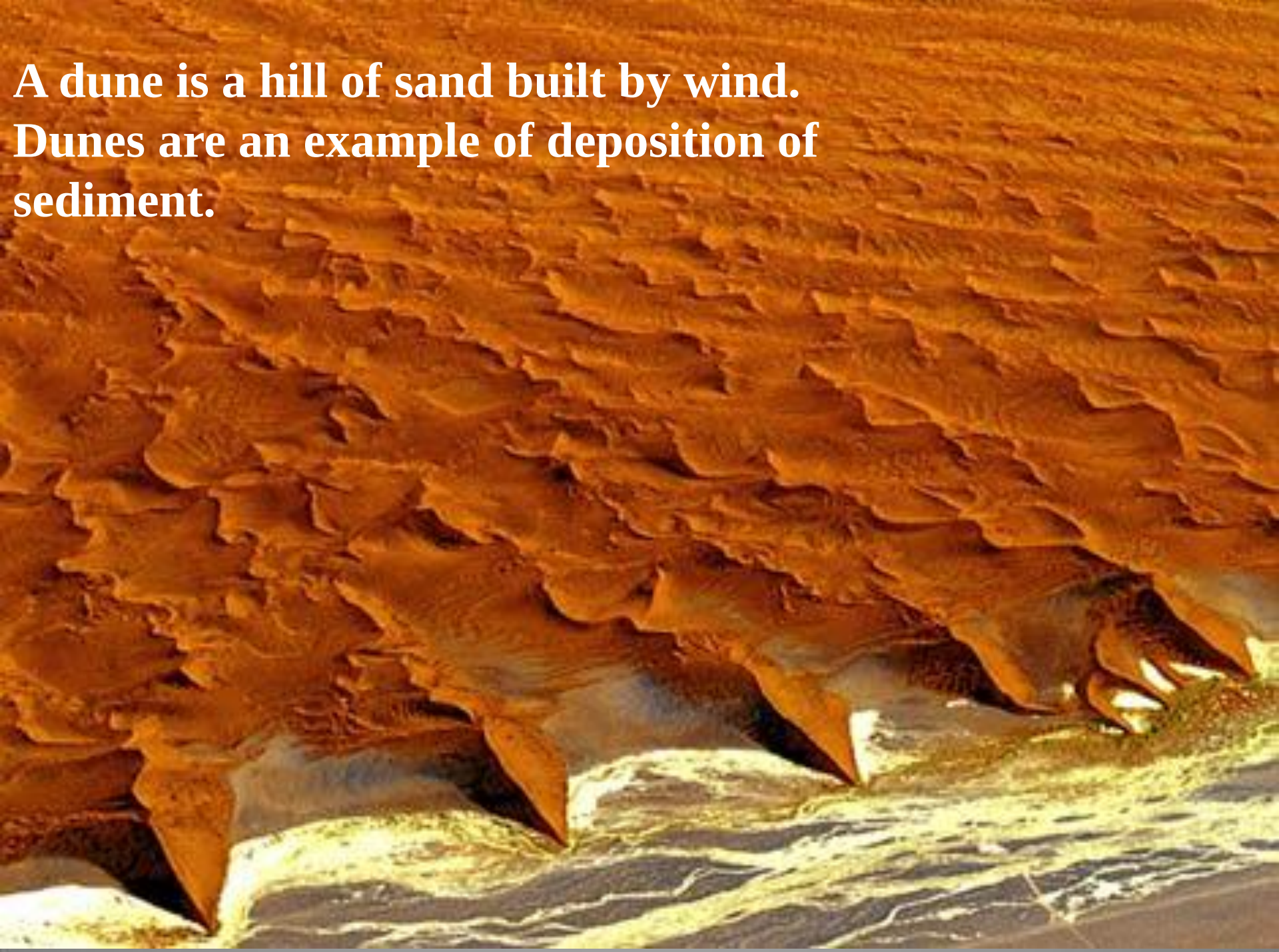
Deposition of sediment

•Deposition of sediment is when sediment is picked up and deposited in another location

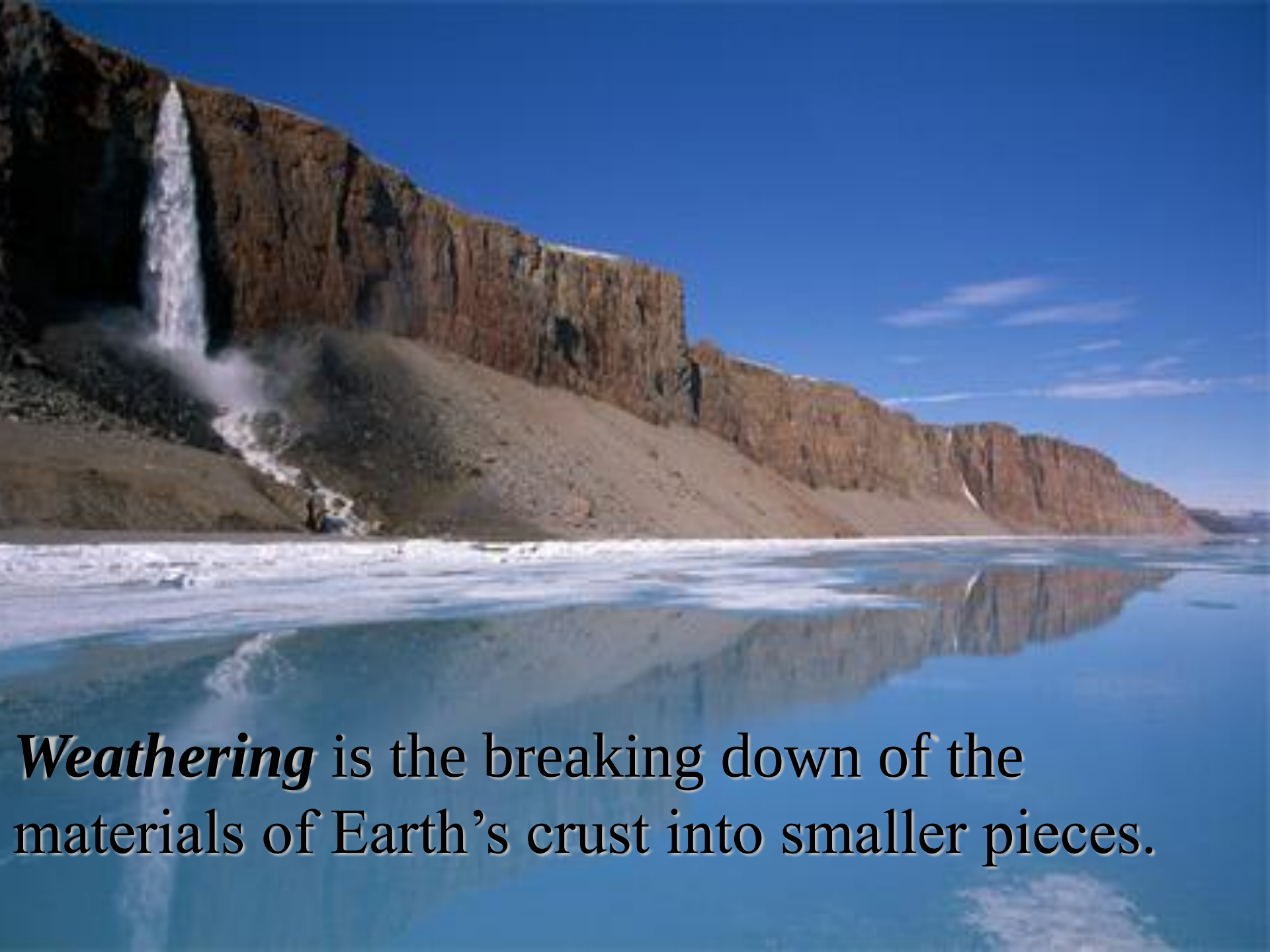
•Occurs because of erosion

•Is a constructive force

Deltas are the result of river dumping sediment and forming new land



A dune is a hill of sand built by wind. Dunes are an example of deposition of sediment.



Weathering is the breaking down of the materials of Earth's crust into smaller pieces.

Quick Reference Table of Constructive and Destructive Forces

Forces	Destructive	Constructive	Both
Deposition			
Earthquakes			
Volcanoes			
Faults			
Erosion			
Weathering			

- Technology and human intervention play and important role in the control of constructive and destructive processes.
- Seismological studies
- Flood control, (dams, levees, storm drain management, etc.)
- Beach Reclamation (Georgia Coastal Islands