

# Clash of Ideas, Episode 3

## Moving Mountains



### Engage

- Why do we have mountains? How do mountains form?
- Why are mountains often in a long line, called a range?
- Why are the rock layers in mountains often tilted?
- What kind of motion would have to happen in order to place older rock on top of younger rock? What two options are given in the video? Of the two options given, which seems to you to be the simplest explanation?
- If you hiked up to the contact between the older and younger materials, and broke apart the rocks right at the contact to see what the contact itself looks like, what would you expect to see, based on the information and the explanation of mountain formation shown in the video?

### Discover

- What does an overthrust look like?

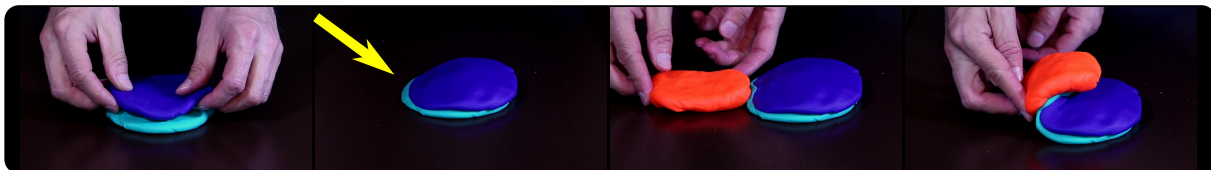
Play-Doh exercise, part I:

Make a Play-Doh cake two layers thick.

Flatten one side of it (yellow arrow).

Form the third color of Play-Doh into a similar flat layer.

Pushing from the edge, slide the third layer up onto the first two.

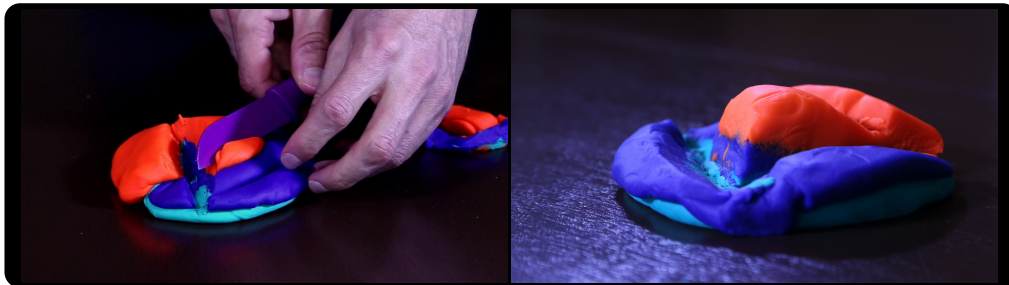


For more information, please see [https://youtu.be/PkZblbJS\\_JU](https://youtu.be/PkZblbJS_JU)

- At the Glarus Overthrust, the contact between the older material and the younger material is a line in the mountain. If you were hiking up past the contact on a trail, you might see a transition from a lighter material to a darker material. How did this happen? The Alps were shaped by glaciers:

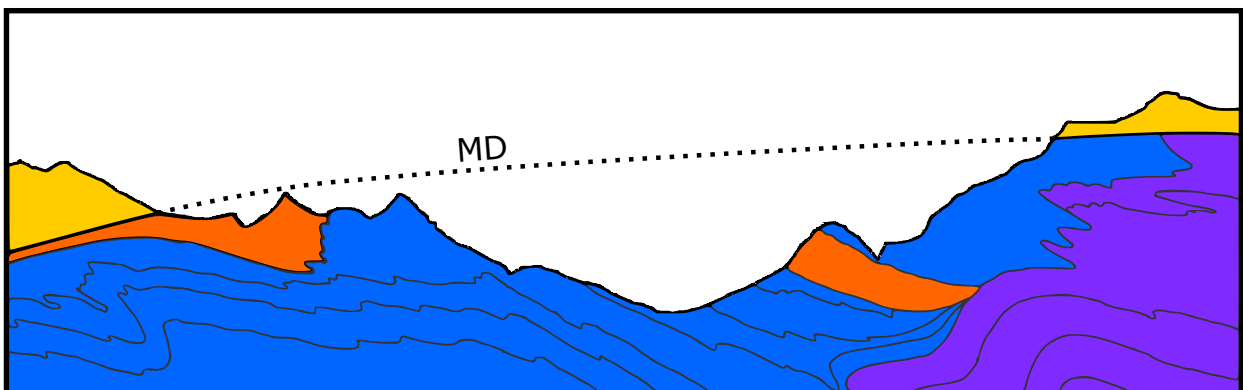
Play-Doh exercise, part II:

Carve out canyons to form mountains between the canyons like the glaciers would have done, leaving layered Play-Doh mountains.



## Explain

- A cross-section of the Glarus Overthrust, which is a vertical slice through the mountain viewed from the side, showing the structure of the layers of rock looks like this:



Adapted from Imper, David. (2011) Elm-Linthal: Crossing the Richetipass. *Federal Office of Topography Swisstopo*.

- The rocks on top, shown in yellow, are the oldest, and the orange, blue, and purple rocks are younger. Originally, all the layers were horizontal, and the two bodies of rock marked in yellow were a continuous layer. The structures (the folding) in the rocks below the line marked "MD" (short for Mürtschen-Decke) happened as a result of the same processes that caused the older material to be pushed over the younger material.

Slickenside is a rock surface that forms when two rocks are forced past each other under a lot of pressure. This photo shows typical slickenside. Might you see something like this at the Glarus Overthrust?



Photo credit: McCalla, Carol. (2008) Glacial striations and slickensides. *Utah Survey Notes*, 40(3).

### Extend

- Rocks the same age as those above and below the overthrust both contain fossils, which means that they were both formed after death entered the world. What was the most violent event in earth's history? When did the overthrust probably happen?

### Assess/Reflect

#### Graphic Organizer

If mountains are formed by vertical motions only:

Layers will often be tilted

Mountains may be found together in groups, or perhaps spaced randomly

There should be some symmetry between the rocks on opposite sides of the mountain

If mountains are formed by lateral movements between tectonic plates:

Layers will often be tilted, or even vertical, and occasionally even upside-down

Mountains will often be found in long ranges

There should not be much symmetry in the rocks between opposite sides of the mountains

- Vocabulary: Overthrust, Tectonic plates, Mountain range, Folding

## Teacher's Resource

### Possible Answers to Questions

- Most mountains formed because of the lateral motion of tectonic plates. In zones where plates collide, mountains are pushed up, and material is pushed down as well. Earthquakes are common in these areas, and happen as stress from the plate motion is released along the plate boundaries. Volcanism is another reason we have mountains, and can also be related to plate motion.
- Mountains tend to be in ranges because the zones where tectonic plates collide can be very long and mountains can be built up along much of the collision zone.
- Rock strata, the layers of rock often visible in the mountain, are often tilted or folded because of the motions of the tectonic plates.

### Vocabulary

**Overthrust:** the movement of certain layers of rock over others, at a very shallow angle (close to horizontal)

**Tectonic plates:** pieces of Earth's crust that fit together like a puzzle

**Mountain range:** a long line of mountains

**Folding:** rock layers are typically formed horizontally, but due to stresses in the earth, they can be bent and deformed

Video for exercise available at:

<http://grisda.org/resources1/audio-visual-media/video-series-clash-of-ideas/moving-mountains/>