Roxi's Cookie Tectonics Script

Take a "scientific tool" — No nibbling yet!

Carefully twist apart your cookie to form two tectonic plates. If one breaks — that's o.k. You just had an earthquake! You can still do the activity.

Regular or double-stuff sandwich cookies work best.

Take the cookie with the most frosting, and put it in your left hand. Put the cookie with less or no frosting in your right hand.

Low fat varieties don't produce a good accretionary wedge!

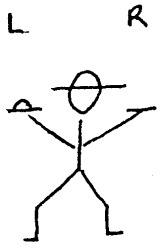
Your pulled-apart cookie now represents two tectonic plates. Remember that the Earth's crust is made of two types of tectonic plates: continental and oceanic.

Which type of plate is heavier and denser? *Oceanic*

Try to have your sandwich cookies at a warm room temperature.

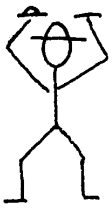
Yes! Oceanic crust is made of denser rock, and it's full of cold, cold seawater.

So — which cookie is the oceanic plate? *The one with the frosting. It's the heavier cookie!*



Your left hand cookie is a slab of ocean crust. In your right hand is the North American Plate, where the west coast is, barely.

Now hold the cookies apart, about shoulder width. Let's imagine ourselves back in time about 180 million years ago, when these two slabs of tectonic plates were thousands of kilometers from one another.



At one edge of your oceanic cookie is a divergent plate boundary, or mid-ocean ridge or seafloor spreading center, where new seafloor is forming.

What type of candy is erupting at our seafloor spreading center? *Jelly beans!* — also known as pillow basalt, the blobby, dark rock that makes up the bottom layer of your oceanic cookie.

When you ask the candy question, you may get the name of the rock as the answer. That's o.k. Just continue the conversation to generate the name of the candy, along with the rock name.

Once the jelly beans form, they start their long, tectonic journey toward your continental cookie. How fast are the jelly beans moving? *About as fast as your fingernails grow!*

For the finger-nail answer:

Give a visual cue with your fingers spread out to prompt the response.

As your jelly beans slowly migrate towards North America, billions and billions (incomprehensible numbers) of microscopic plankton live and die in the ocean.

Your fingernails grow about 5 cm per year.

The beautiful, ornate silica skeletons of tiny radiolarians drift down through the water column, in a process Rachel Carson called "the long snowfall" — for if you were in your deep sea submersible, shining your submarine spotlight into the black abyss, it would look like you were surrounded by snowflakes — the flakes being the skeletons of uncountable dead plankton.

Rachel Carson reference: The Sea Around Us

The radiolarian skeletons land on top of your jelly bean pillow basalt, first forming an ooze, and then forming a hard, blocky rock, which you know as what kind of candy? *Jolly Ranchers! Also known as radiolarian chert.*

The jolly ranchers form another layer of your frosting.

The jelly beans and jolly ranchers continue their journey to your continental cookie. Eventually your oceanic cookie collides with North America.

What happens when an oceanic plate collides, or converges, with a continental plate? *Subduction!*

Which cookie will sink, or be subducted, back into the Earth's mantle? *The oceanic cookie!*

Yes! It's heavier, denser, and loaded with cold, cold seawater.

As your oceanic cookie begins to subduct, underwater earthquakes, underwater avalanches and mud flows occur along the edge of the North American Plate, along a trench near the subduction zone. Sediments from the ocean and continent are mixed up to form one last Franciscan rock — a gritty rock with a funny name — which rock is it? *Graywacke!*

And graywacke is which candy? *The gumdrop!*

*Don't worry if a cookie breaks during "subduction." **Big** earthquakes occur near subduction zones!*

The gumdrop rock forms another layer of your frosting.

Now — go ahead and subduct your oceanic cookie, scraping off your frosting onto the edge of your North American cookie, forming a new part of California.

Try to form a high, steep mound of frosting.

Let's see the features from the Franciscan rocks you have formed:

The Coast Ranges (look for linear mounds of frosting)
Twin Peaks of San Francisco
The hills of the Marin Headlands
Mount Tamalpais
Mount Diablo
The hills of the Presidio, SF

Look around at the participants, and name a few of the Franciscan features they have formed with their scraped-off frosting.

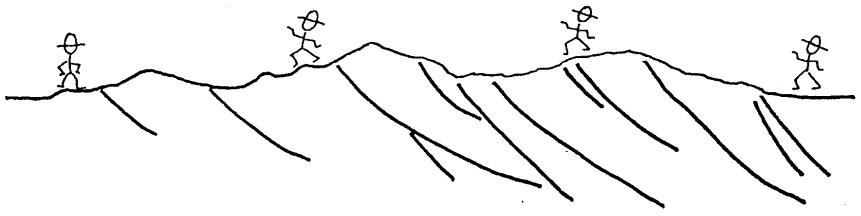
Remember — when you explore California east of the San Andreas Fault, you are walking on the frosting!

Now, if you wish, you may "weather" your tectonic plates!

Note:

During this activity, I find it best to leave the oceanic plate nameless, if my audience is middle school age, or new to plate tectonics. An ancient oceanic plate, the Farallon Plate, is responsible for transporting the Franciscan rocks to the North American Plate.

The Farallon Plate is lost to us, consumed by subduction, except for a small remnant (the Juan de Fuca Plate of the Cascadia Subduction Zone). Your oceanic cookie is ***NOT*** *the Pacific Plate. This activity depicts the era of Franciscan rock transport to the subduction zone, from about 180mya to about 30mya. The Pacific Plate arrives at the west coast about 30mya, ushering in the era of transform plate boundary movement and development of the San Andreas fault zone.*



Roxi_Farwell@nps.gov