SLOWFLOWING SOLIDS EXPLAIN TECTONIC PLATE MOVEMENT

BRITT ARGOW: The Earth's interior is divided up into the crust, the mantle, and the outer and inner core.

JOE REILLY: In the core, there are metals that can melt at really high pressures, but in the mantle, there are different minerals that generally stay solid until you get up closer to the mantle/crust boundary.

ARGOW: Here, the decrease in pressure allows parts of the upper mantle to melt. This area is really a mush, a mixture of melted rock and crystallized solid minerals. It's a solid material that takes on some fluid, or flowing, properties. Many scientists consider this area of the Earth's interior to be a fluid solid: a solid that can flow.

KEITH KLEPEIS: And to help us understand this, I've just taken a bit of Play-Doh, and you can take gum or Silly Putty, anything that you can squish around with your hands. I'm going to take some Play-Doh and I'm going to show you this idea of a solid material that can behave a little bit like a liquid – it can flow. So if I pull this very slowly, you see I can make this flow. And with time, I can make different shapes. And it's flowing along just like a liquid would do. If I actually take the same material, pull it apart quite quickly, I can actually make it break. And that's one way to think about rocks. If you pull them very slowly, or in some places, like volcanoes, if temperatures are high enough, some of that solid property of rock...well, you can have solid material that behaves like a liquid.

ARGOW: This idea of a flowing solid can also help us to understand how the plates move.

KLEPEIS: So if you remember, plate tectonics is this idea that we have a rigid outer material called the Earth's crust, and that crust is moving on top of material that's inside the Earth. Now, if some of those layers inside the Earth actually have liquid-like properties, it makes this easier to understand how this rigid crust can move across. And one way to think about this is to take the Play-Doh and put it between your hands. And so in this little model

here I've made, the Play-Doh represents a weak layer inside the Earth, my hand on top is the rigid outer crust of the Earth. And I'm going to move my hand, just apply some pressure, and you'll notice that the Play-Doh is flowing. It's displaying properties very much like a liquid. And my hand is rigid; it's not actually deforming or breaking in any way. That's the way to think about plates. It's moving across a very weak layer that looks like it has liquid properties.

ARGOW: This is how scientists believe plates are able to move. Because a portion of the upper part of the mantle becomes partially molten, this provides the surface on which solid rock can glide over solid rock. The plates are not just the crust of the Earth, they're a combination of crust and the uppermost part of the mantle. This is known as the lithosphere. The lithosphere glides across a weak layer of the mantle called the asthenosphere. Lithospheric plates can be anywhere from ten kilometers to 100 kilometers thick.