1. Plate Tectonics and Earth's Structure

Plate tectonics accounts for important features of Earth's surface and major geologic events. As a basis for understanding this concept:

a. Students know evidence of plate tectonics is derived from the fit of the continents; the location of earthquakes, volcanoes, and mid-ocean ridges; and the distribution of fossils, rock types, and ancient climatic zones.

b. Students know Earth is composed of several layers: a cold, brittle lithosphere; a hot, convecting mantle; and a dense, metallic core.

c. Students know lithospheric plates the size of continents and oceans move at rates of centimeters per year in response to movements in the mantle.

d. Students know that earthquakes are sudden motions along breaks in the crust called faults and that volcanoes and fissures are locations where magma reaches the surface.

e. Students know major geologic events, such as earthquakes, volcanic eruptions, and mountain building, result from plate motions.

f. Students know how to explain major features of California geology (including mountains, faults, volcanoes) in terms of plate tectonics.

g. Students know how to determine the epicenter of an earthquake and know that the effects of an earthquake on any region vary, depending on the size of the earthquake, the distance of the region from the epicenter, the local geology, and the type of construction in the region.

To my dear young Friends in California,

After I talked at your school I learned that you are supposed to be studying the Earth Sciences this year. These are the sciences that deal with the solid earth, the oceans, and the atmosphere.

The firs thing you are supposed to understand is what's called "Plate Tectonics."

To prepare your mind to receive this branch of science you must understand how old the earth is. When I was your age almost everyone believed that our earth was only a few thousand years old. But just as the previous century had proved that the universe is much **bigger** than previously thought, so in my time, we scientists began to see that the universe and especially our earth is much **older** than believed. The size of things and the age of things, two great revolutions in our ways of thinking.

We now know that the earth is about four and a half billion years old. How old is that? Well, if you took just one penny a day and added it to a stack of pennies for four and half billion years—your stack would reach from the center of the earth all the way to the moon nearly seven times. As you will have guessed, a lot of changes can happen in that period of time. And many of those changes came about through Plate Tectonics.

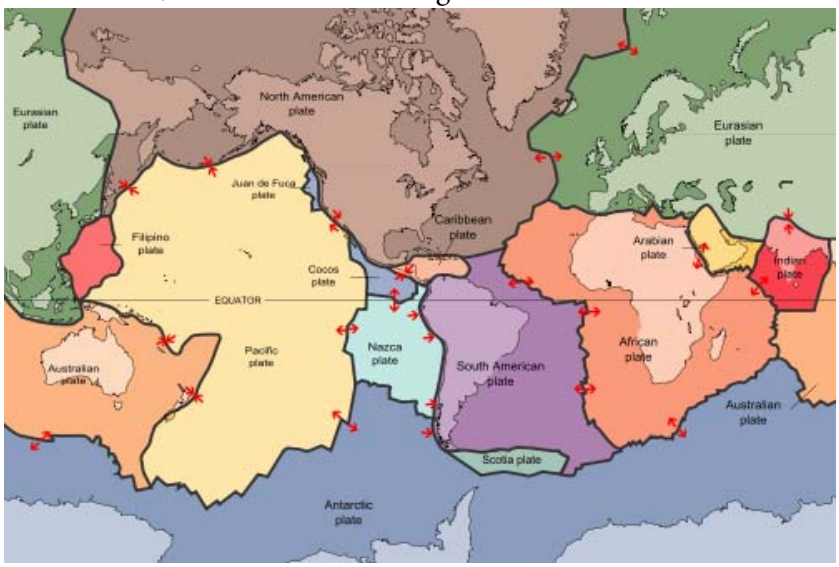
But isn't that a rather amusing name: “Plate tectonics”? We think of plates as things we eat off of, not things we live on. And “tectonics”—what's *that?*

Tectonics comes from the ancient Greek word for “carpenter”. In Geology it refers not to the buildings made by human beings, but to the processes that build mountains, valleys, islands, and even continents. But what could this have to do with plates?

Well. one of the great discoveries of the last century was that the crust of the earth is divided into huge plates.

Imagine a soft boiled egg whose shell has cracked, although it hasn't broken open. Imagine seven large pieces of shell with a number of smaller pieces between them. Imagine that these huge pieces can move independently of each other. Sometimes sliding in opposite directions, sometimes crashing into each other with one sliding under and the other on top. That's the crust of our earth!

Here is a map showing the important pieces of the egg-shell we live on. Each plate has a different color and you can see the continents sketched in under the colors. You can see that you, in California, live on the western edge of the North American Plate:



This map shows where the plates are today. But as I said, they are sliding over the molten core of our huge soft boiled egg. Not very fast, mind you. Much slower than a snail moving across a garden, or your pile of pennies on its way to the moon. In fact, only between one and four inches per year.
But over many centuries, those inches really add up. And those super-slow-motion crashes change the face of the planet. Over the course of centuries they build the mountains—including your own Sierra Nevada—they power the earthquakes, they allow molten rock to shoot up to the surface in volcanic eruptions, and they even move the continents apart. All of this is what we call call “continental drift”.

You can start learning a little more about the plates moving at this web site: http://www.cotf.edu/ete/modules/msese/earthsysflr/plates1.html

But here is something that really startled me when it was discovered: We now have lots of evidence to believe that all our continents were once joined together in a super-continent about 300 million years ago. Then about a hundred million years later this super-continent began breaking apart as monumental forces began to push and pull the plates in different directions. And that led to the distribution of continents that we now live on.

I wish I had time to tell you of all the fabulous evidence we had gathered to construct this beautiful theory, but, for better or worse, you will have to do that research without me. Fortunately, you have Wikipedia and if you just go to the article on "plate tectonics" and start reading the many links, you will soon get a very detailed picture of what we know and what still needs more investigation.

Your teacher can help you learn how the movements of these plates account for earthquakes, volcanoes, and tsunamis.

Yours most sincerely, in the spirit of eternal curiosity,

Joseph Priestley