***Important information to accompany* the**

***Spreading in the South Atlantic, cut globe movies***

This movie hows a cut-globe view of the spreading of South America away from Africa to form the South Atlantic Ocean between about 130 million years ago and the present. Two versions are offered: simple plate motions and plate motions with likely mantle convection patterns.

Created by Tanya Atwater using Photoshop, Morph, and Final Cut Pro. Continental outlines on the globe surface from http://www.odsn.de/odsn/services/paleomap/. Earlier versions created by Carrie Glavich in Flash.

**Some notes from Atwater about plate driving mechanisms and mantle convection (according to Atwater’s understanding)**

In most elementary textbooks, the mantle is depicted as a boiling pot, with convecting fluid (the mantle) that carries the surface scum (the plates) around. The plates are depicted as passive floaters drifting on the underlying current. This is not a model believed by most experts in the field; rather, they envision the geometry as follows

The oceanic lithosphere is mostly made of cooled upper mantle rocks (with a thin layer of oceanic crust coated on top). Thus, they are about the same composition as the adjacent hot mantle, but cooler and denser. Because of this difference in density, the motions of the plates are mostly driven by their own weight, slipping downhill off of the mid-ocean ridges and falling down through the mantle at the subduction zones. Phase changes in the upper mantle and in the down-going slabs enhance these density differences. Thus, ***most convection patterns in the upper mantle are driven by the motions of the plates, themselves, not vice-versa. The plates, themselves, are the tops and the descending sides of the convection cells.***

At the spreading centers the plates slip downhill, away from the mid-ocean ridges, creating a low pressure region beneath the center and drawing up the underlying asthenosphere into the widening crack. Thus, mantle upwelling beneath the center is localized and is driven by the departing plates.

Beneath the moving surface plates, the plates drag the asthenosphere along. In models of plate driving mechanisms, the friction between the lithosphere and underlying asthenosphere is believed ***resist*** the plate motion in most places, not to drive it.

At the subduction zones, the cold, down-going slabs entrain the surrounding

asthenospheric mantle, dragging it downward. This, in turn, pulls new asthenosphere toward the subduction zone tops, perhaps helping to move the overriding plates in these locales. The most dramatic mantle convection, called the "corner flow", occurs where the slab separates from the bottom of the overriding plate, entraining and removing local asthenosphere that then must be replaced by inflow from the side. (Among other things, this process continually renews the heat and fertility of the mantle wedge beneath the arc magmatic belt.)

The animation clips and materials on this site are free works. You may download, copy, distribute, and modify them as suits your purposes. Acknowledgement of authorship and reference to this website is appreciated. Note that many were constructed in the early 2000s when computer files were much more restricted in size and delivery rate. Hopefully some are still useful.

Complaints, corrections, comments and, especially, suggestions for how to make these materials more useful are always welcomed: atwater@geol.ucsb.edu