

Re: What is this convection cell nonsense

Source: <http://sci.tech--archive.net/Archive/sci.geo.geology/2007-08/msg00188.html>

- *From:* Darwin123 <drosen0000@xxxxxxxxxx>
 - *Date:* Sat, 11 Aug 2007 17:16:11 -0700
-

On Aug 11, 12:24 pm, oriel36 <geraldkelle...@xxxxxxxxxx> wrote:

On Aug 10, 6:29 pm, Darwin123 <drosen0...@xxxxxxxxxx> wrote:

Be my guest, stick with your silly convection cells for crustal motion but do not forget that it is useless for explaining why the shape of the planet is not a perfect sphere.

The earth is oblate because it acts as a fluid. The convection cells are not necessary to explain the oblateness, but they are themselves a consequence of the fluid-like behavior of rock on large scales of distance and time.

For convenience, I will use the reference frame of a rotating earth. One can compensate for the noninertial aspect of the frame by introducing a centrifugal force. I can explain it just as accurately in an inertial frame, but I think this gets to the point faster.

There are three forces acting on a fluid element on the surface of the earth. Two of those forces are gravity and elasticity. At the poles, these are the only two forces. The balance pulls the surface close to the earth. At the equator, due to the rotation of the earth seen in an inertial frame, there is centrifugal force. The centrifugal force pushes the earth outward, so it bulges at the equator. The three forces balance out.

The elasticity turns out to be a fluid pressure, with few shear forces. This is easily seen from merely a fluid statics analysis. Because the surface of the earth approximately forms a geodesic with respect to the sum of gravitational and centrifugal forces. The effective gravitational acceleration of the earth is the same at the poles as at the equator. Here, effective includes both gravitational and centrifugal force. It wouldn't do that unless the rock really was acting as a fluid on a long time scale.

The small deviations caused by temperature differences couldn't change the geodesic part of the problem. Hence convection is irrelevant to the average shape of the earth itself. Treating the earth as an axially symmetric body is no problem. This is merely a consequence of the fact that the fluid in the earth is nearly static. Once you allow a small amount of fluid motion into your model,

Re: What is this convection cell nonsense

you open up the possibility of nonaxial geometry. Differential rotation the way you describe it is a fluid motion that is forced to have axial symmetry. There is no law in fluid mechanics that requires the motion of a fluid to have an axial symmetry. It is this axial symmetry that YOU propose that is ad hoc, not the concept convective currents. Once you have a temperature gradient in a fluid under the action of gravity, convective currents must form.

Thus, it is really your model that seems to have the ad hoc axial symmetry. Projecting the fallacy of axial symmetry on the plate tectonics model is deceptive. No geologist or physicist ever said that plate tectonic theory is inherently axial, let alone spherical. You have been attacking a straw man model.

.