Reconsidering Convection Cells – Teacher Notes

Problems with this theory:

1. **Classic convection cells have not yet been found in either the asthenosphere or mantle. Ongoing fluid flow does not appear to have happened in the last 2 billion years.**

2. **Mid oceanic ridges are not fixed and static but appear to have moved over geological time. The mid-Atlantic ridge is a case in point.**

3. **At subduction zones slabs sink faster than they converge suggesting gravity as the driving force at this location.**

4. **Almost 90% of our volcanoes occur in "arcs" where oceanic plate is drawn under continental crust. The volcanic material formed can be silica rich, like continental crust not iron and magnesium rich like melted oceanic crust.**

"Science changes its thinking as new ideas come along" Tim Minchin

> ***"Nature and development of science***
> . *Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community* *(ACSHE157)*
> . *Advances in scientific understanding often rely on developments in technology and technological advances are often linked to scientific discoveries* *(ACSHE158)*
> " ACARA Australian Curriculum v5.2"

Current thinking = Slab pull

As oceanic plates move apart at mid-oceanic ridges their mafic volcanic rocks cool and become denser. The further they are away from the ridge the cooler and denser they become. Gravity causes this basalt rich crust to sag into the underlying lithosphere. This tension on either side of the ridge maintains the central trench.

Fresh basalts from the ridge flow down into the oceanic basin causing the oceanic plate to thicken. Basin sediments can also build up above them to a depth of about 5km.

Increasing gravitational force pulling on the older, colder and denser oceanic crust creates a bend or "hinge zone" in the oceanic slab and it is down warped at some distance away from the ridge. The down warped part pulls on newer portions of the oceanic crust behind it.

At a zone of convergence the down warped slab will travel below less dense younger oceanic plate or less dense continental plate and rapidly travel on down into the hotter mantle. An oceanic trench forms above it. As the slab slides down, melted sediments and out gassed water will rise through the overlying crust to produce explosive silica rich volcanic outpourings. Farther under the overlying slab, partial melting may produce more mafic intrusions and outpourings.

A rapidly downward moving slab will stretch, thin and rotate the continental crust margin. This slab pull explains passive volcanic outflows in back arc basins well behind the continental margin.

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Research geologists at the University of Western Australia are computer modeling what might happen when different types of crust are subducted and partially melted. Their research informs present mineral exploration. (*Non-linear thermo mechanics of folding in geomaterials*, Paesold, M. K., Regenaur-Lieb, K., Bassom, A.P., Ord. A., Hobbs, B.E. 2013)

Current thinking leans towards the concept that heating produces expansion which is a minor force in tectonic movement. Slab pull is the major driving force.