

Re: Now, our famous geologist confuses continental rift and ocean.

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- *From:* don findlay <don@xxxxxxxxxxxxx>
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Florian wrote:

Stuart <bigdakine@xxxxxxx> wrote:

Fact is, I haven't seen such a blatant manipulation of the written word outside of creationist circles. I don't see where Doglioni refutes slab pull; he thinks slab pull alone is too simplistic. That's hardly a refutation.

Fact is, *I* haven't seen such a blatant manipulation of the written word outside of creationist circles.

Doglioni does clearly refute the slab pull concept (see below)

This demonstrates perfectly the mindset of EEr's.

This demonstrates perfectly the mindset of Stuart Weinstein. I'm glad to put your nose in your own bullshit.

Doglioni wrote:

"The main reasons why the slab pull is not considered here a good mechanism for moving plates and for triggering subduction are listed.

1) The dip of the slab is independent from the age of the oceanic lithosphere (Cruciani et al., 2005), considered to control the increase of the lithosphere's density and likely, therefore, to be the magnitude of the slab's pull forces.

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2) Subduction involves even continental lithosphere even deeper than 100–150 km (Ampferer, 1906; Dal Piaz et al., 1972; Trýmpy, 1975; Ranalli et al., 2000; van Hinsbergen et al., 2005), although the subducted average continental crust is most probably buoyant with respect to mantle rocks (Hermann, 2002).

3) The oceanic lithosphere is a frozen shallow (30–100 km deep) asthenosphere, previously depleted below ridges. Therefore, the oceanic lithosphere is the differentiated lighter upper part of the mantle: then why should it be heavier a priori than the undepleted deeper (100– 300 km) asthenosphere lying beneath the old oceanic lithosphere where a pyrolite density of 3400 kg/m³(Jordan, 1988; Kelly et al., 2003) is inferred? Moreover, hydrothermal activity generates serpentinization of the mantle along the ridge that decreases the density even more.

4) If the oceanic lithosphere is heavier than the underlying mantle, why are there no blobs of LID falling in the upper mantle, below the western, older side of the Pacific plate?

5) Down–dip compression (Fig. 9) affects most of the W–directed slabs, all below 300 km (Isacks and Molnar, 1971), and most of them at an even shallower depth (e.g., Frepoli et al., 1996).

6) We do not have hard constraints of the real composition of the country's upper mantle: there could be more fayalite, making the upper mantle more dense and the slab's negative buoyancy smaller, or none.

7) The 700 km long W–Pacific slab, where only the upper 300 km show some potential down– dip extension seismicity [but it could be generated also by a horizontal shear in the mantle, Giardini and Woodhouse (1986)] should pull and carry the 10,000 km wide Pacific plate, 33 times bigger, winning the strong shear resistance at the plate base, and the opposing basal drag induced by the relative eastward mantle flow inferred from the hotspots migration (Fig.10).

8) At the Earth's surface, the oceanic lithosphere has a low strength under extension [e.g., $8 \times 10^{12} \text{ N m}^{-1}$, Liu et al. (2004)] and is able to resist a force smaller than that requested by the slab pull [$3.3 \times 10^{13} \text{ N m}^{-1}$, Turcotte and Schubert (2002)]. If the slab pull is the cause of the motion of the Pacific plate, this observation argues in favour of a stretching of the Pacific lithosphere before the slab pull is able to move the plate. In other words, the plate cannot sustain the tensional stresses, that could eventually be due to slab pull (Fig. 11). The problem of low lithospheric strength could be, however, partly counterbalanced by the mantle flow and viscous tractions acting on the plates and induced by slab sinking (e.g., Lithgow– Bertelloni and Richards, 1998). Due to the low temperature and high pressure, the strength of the subducted oceanic lithosphere rises to some 2×10^{13} – $6 \times 10^{13} \text{ N m}^{-1}$ (Wong a Ton and Wortel, 1997) and would make the eventual pull, induced by density anomalies related to phase changes at depth sustainable. In short, the subducted slab is probably able to

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sustain the load induced by the slab pull but probably, this load cannot be transmitted to the unsubducted portion of the plate without breaking it apart.

9) Faster plates surrounded by long slabs and trenches? It is a circular reasoning because long subduction zones might be a consequence of fast movements of plates. Moreover, plates are considered fast in the NNR reference frame (Conrad and Lithgow-Bertelloni, 2003). For example, measuring plate motions in the hotspot reference frame, i.e., relative to the mantle, Nazca is very slow relative to the mantle, so the relation plate velocity–slab age and length of the subduction zone (Fig. 12) is not true.

10) Plate velocities in the hotspot reference frame seem to be inversely proportional to the viscosity of the asthenosphere rather than to the length of the subduction zones and the age of the downgoing lithosphere. In fact the Pacific, which is the fastest westerly moving plate (Gripp and Gordon, 2002), has the lowest viscosity values (Pollitz et al., 1998).

11) The horizontal velocity of plates is 10–100 times faster than vertical velocity (subduction related uplift or subsidence) suggesting that vertical motions are rather passive movements. Moreover, the kinematic analysis of section 2 shows that subduction rates appear controlled rather than controlling horizontal plate motions (Fig. 8).

12) The energy for compressing an orogen is probably larger than the one supposed for the slab pull.

13) Slab pull has been calculated to be potentially efficient only at a certain depth [e.g. 180 km, McKenzie (1977)]; and if it is shallower than that? How does subduction initiate?

14) Some plates in the hotspot reference frame move without any slab pulling them, e.g., the westward movements of N–America, Africa and South America (Gripp and Gordon, 2002).

15) There are rift zones formed between plates not surrounded by oceanic subduction to which one can attribute the pull for moving the lithosphere (e.g., the Red Sea).

16) Although the knowledge of the rheological behaviour of the subducted lithosphere is very poor it can be conjectured that the downgoing slab, being progressively heated, could potentially lose strength, diminishing the possibility of mechanically transferring the pull (Mantovani et al., 2002).

Re: Now, our famous geologist confuses continental rift and ocean.

17) Kinematically, subduction rollback implies that the volumes left in the hangingwall of the slab have to be replaced by a horizontal mantle flow, whether this is a consequence or the cause of the retreat (Doglioni et al., 1999). However, in order to allow the slab to move back, the slab retreat needs the mantle in the footwall of the slab to also move away in the direction of the slab retreat, regardless whether this motion is generated by the slab pull or is an independent mantle horizontal flow. But the energy required to push the mantle forward is much greater than the slab pull can effort.

18) When describing the plate motions relative to the mantle, e.g. in the hotspots reference frame, along E- or NE-directed subduction zones the slab might move out of the mantle, e.g., in the opposite direction of the subduction. It is sinking because it is overridden by the faster upper plate (Fig. 13).

19) Within a slab, eclogitization is assumed to make the lithosphere denser. However, eclogitization is concentrated in the 6–8 km thick oceanic crust, whereas the remaining 60– 80 km thick lithospheric mantle does not undergo the same transformation. Therefore only 1/10 of the slab is apparently increasing density, but the main mass of the slab (90%) does not change significantly.

20) The density increase due to eclogitization is in contrast with the exhumation of the eclogitic prism that is usually detached with respect to the "lighter" lithospheric mantle (G.V. Dal Piaz, pers. comm.).

21) Why should the lithosphere start to subduct? This crucial point arises particularly when considering an oceanic hydrated and serpentinized lithosphere that has not yet been metamorphosed by the subduction process, and consequently it is still less dense (G.V. Dal Piaz, pers. comm.).

Yes, ..but so what? He didn't actually say slab pull was a *BAD* explanation did he? He only listed 21 reasons why it was not a *good* one. My objection stands, I still don't see where he refutes slab-pull. All of those 21 reasons are just reasons why slab pull is too simplistic. Hardly refutation, is it?

Stuart.

This long list casts doubts on the possibility that the slab pull can actually trigger subduction, slab rollback, and drive plate motions."

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Florian

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"Toute vérité franchit trois étapes. D'abord elle est ridiculisée. Ensuite, elle subit une forte opposition. Puis, elle est considérée comme ayant toujours été une évidence." – Arthur Schopenhauer