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1 Lithosphere-Asthenosphere decoupling

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The Hawaii hotspot trail supports a decoupling between the lithosphere and the source of the magmatism, whatever its depth. A torque must act on the lithosphere to determine this shear zone. The most popular torque so far proposed is the slab pull, but the energy required to drag plates is far bigger than the strength of the lithosphere under extension. We alternatively model a rotational drag acting on a very low-viscosity intra-asthenospheric layer, and generating the net "W-ward" rotation of the lithosphere. An ultra-low viscosity layer is required in order to have rotational processes feasible. The viscosity of the asthenosphere measured parallel to the shear is $<<$ than the viscosity measured by vertically loading or unloading the mantle in post-glacial rebound studies that also rather describe the viscosity averaging the whole asthenosphere and not of single internal layers. Therefore, hydrated and ultra-low viscosity intra-asthenospheric layers might have been hidden to present techniques of viscosity estimation.

The lithosphere-asthenosphere decoupling, when acting on localized higher viscosity sections might determine peaks of viscous heating ($>100^{\circ}$C) which could be responsible for the origin of intraplate Pacific hotspots. The shallow intra-asthenospheric origin of hotspots would raise the Pacific velocity from 10 cm/yr to a faster hypothetic velocity of about 20 cm/yr. In this setting, the W-ward drift of the lithosphere relative to the deep mantle would increase from about 4.9 cm/yr (deep sourced hotspots) to more than 10 cm/yr (shallow sourced hotspots). In this configuration all plates move "W-ward" along an undulated sinusoidal stream. A polarized upper mantle circuit is proposed, where the oceanic lithosphere is the frozen depleted part of the upper as-

thenosphere, refertilizing the upper mantle along E- or NE-directed subduction zones. Lateral variations in viscosity of the decoupling layer may determine velocity gradients in the overlying lithosphere, i.e., plate tectonics.