Geophysical Research Abstracts
Vol. 13, EGU2011-7050, 2011
EGU General Assembly 2011

Overriding plate thickness, trench dynamics and flat-slab subduction

Vlad Constantin Manea (1), Marta Perez-Gussinye (2), and Marina Manea ()

(1) Computational Geodynamics Laboratory, Geosciences Center, UNAM, Juriquilla, Mexico (vlad_manea@yahoo.com), (2) Dept. Of Earth Sciences, Royal Holloway University of London, Egham Hill, Egham TW200EX, UK

How and why normally dipping subduction zones evolve into flat subduction ones has been long debated. It has been suggested that slab flattening in South America results from subduction of buoyant aseismic ridges or trenchward motion of the overriding plate. However numerical models suggest that, given the plate velocities for Nazca and South America, the actual ridge dimensions are too small to induce flattening of such large slab segments. Here we note that in this continent, flat subduction occurs where thick cratonic lithosphere is close to the trench. We develop time-dependent numerical experiments to show that flat subduction can result from a combination of trenchward motion of thick cratonic lithosphere accompanied by trench roll-back. If the trench retreats as the craton approaches it, the asthenospheric wedge progressively closes and the suction forces increase enough to generate, in some cases, flat subduction. We model the last 30 Myr of subduction in the Chilean flat slab segment and demonstrate that trenchward motion of cratonic lithosphere, 200-300 km thick, presently $\sim$700-800 km away from the trench, reproduces a flat-slab geometry that fits the stress pattern, seismicity distribution, and the temporal and spatial evolution of deformation and volcanism in the region.