



Dynamics of Arc-Continent collision in Taiwan: insights from 3-D numerical modeling

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The orogeny of Taiwan is situated on the boundary between the Philippine Sea plate and the Eurasian plate and has long been regarded as one of the world's foremost natural laboratories for studies of mountain building. However, the plate tectonic setting around Taiwan is more complicated than the characterization as an Arc-Continent collision. The Philippine Sea plate is the upper plate southern Taiwan and the lower plate northern Taiwan. This is an untenable plate tectonic situations and must result in either a change in the relative motion of the two plates or the formation of a new plate boundary in order to accommodate continued convergence, such as Eurasian plate tearing (Lallemand et al., 2001) versus slab breakoff (Teng et al., 2000).

The exposed geology and geophysics can thus be interpreted as being the product of two processes: (1) the collision of the Luzon Arc with the Asian passive margin and its propagation to the South and (2) the interlocking of the South China Sea and Ryukyu slabs beneath northern Taiwan and the subsequent plate tearing either on an EW structures or slab breakoff from N to S beneath Taiwan.

Here, we employ the parallel 3-D code LaMEM (Lithosphere and Mantle Evolution Model), using a marker and cell/staggered grid finite difference approach while simultaneously taking mantle flow and an internal free surface into account to test the physical plausibility of these two processes firstly. We study the effects of rheology, the influence of the Luzon Arc, the effect of a passive continental margin and the effects of boundary conditions on the model evolution to investigate the crustal exhumation, mantle circulation, lithospheric deformation, and the development of a double subduction collision zone in Taiwan region. We compare the models with the geological constraints of Taiwan.

Lallemand, S., Font, Y., Bijwaard, H., and Kao, H., 2001. New insights on 3-D plates interaction near Taiwan from tomography and tectonic implications. *Tectonophysics*, v. 335, p.229-253.

Teng, L.S., Lee, C.T., Tsai, Y.B., and Hsiao, L.Y., 2000. Slab breakoff as a mechanism for flipping of subduction polarity in Taiwan. *Geology*, v. 28, p. 155-158.