



Tomographic constraints on flipping of subduction during arc-continent collision near Taiwan and the role of progressive continental delamination

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Striking improvements in global and local tomography allow for testing of models of the progressive oblique arc-continent collision and flipping of subduction polarity that is occurring near Taiwan. Furthermore they reveal previously unpredicted phenomena, including the delamination of continental mantle lithosphere as an integral part of the progressive 3D collisional and flipping process, with lateral inflow of hot upper mantle.

Classic plate-kinematic models recognize that the oblique collision of the N-S trending Luzon arc of the Philippine Sea plate with the NE-SW trending China continental margin in Taiwan requires a progressive tearing of the Eurasian plate along the continental margin because flipping of subduction polarity is associated with progressive termination of collision. From Taiwan to the northeast the Philippine Sea plate subducts under the Eurasian plate along the continental margin, whereas from Taiwan to the south the Eurasian plate subducts under the Philippine-Sea plate.

Modern global tomography (Li et al., 2008, MIT08, 70km grid) augmented with local tomography near Taiwan (Wu et al., 2007) provides good imaging of the subducted Eurasian and Philippine-Sea lithosphere in the upper mantle and images the predicted torn subducted edge of the Eurasian slab. The observed inclination of this torn slab edge is consistent with the orientation of the continental margin relative to the Luzon arc, in agreement with simple plate-kinematic models of progressive tearing. However, it is perhaps more surprising that the location of the tear is not at the edge of the continent but ~ 200 km inboard, under the Eurasian continental shelf. Furthermore the tear does not propagate into the overlying crust, therefore the continental mantle under the final collisional mountain belt subducts by delamination attached to the oceanic part of the Eurasian plate. This delamination process occurs instantaneously in the zone of flipping and involves the progressive lateral intrusion of hot mantle into this migrating zone from the Okinawa-Ryukyu mantle wedge, which lies above the subducting Philippine-Sea plate northeast of Taiwan. A continuous channel of low velocity mantle is imaged in the global tomography connecting between the site of delamination and flipping under northern Taiwan, through the mantle wedge and into the massive reservoir of hot upper mantle that lies under southeast China, sometimes called the "Hainan plume." The active Okinawa trough back-arc basin that extends northeast from northern Taiwan lies above the southeastern edge of the delaminated region.