

## The transition from oceanic to continental subduction, illuminated by multi-scale deep transects of the oblique Taiwan arc-continent collision

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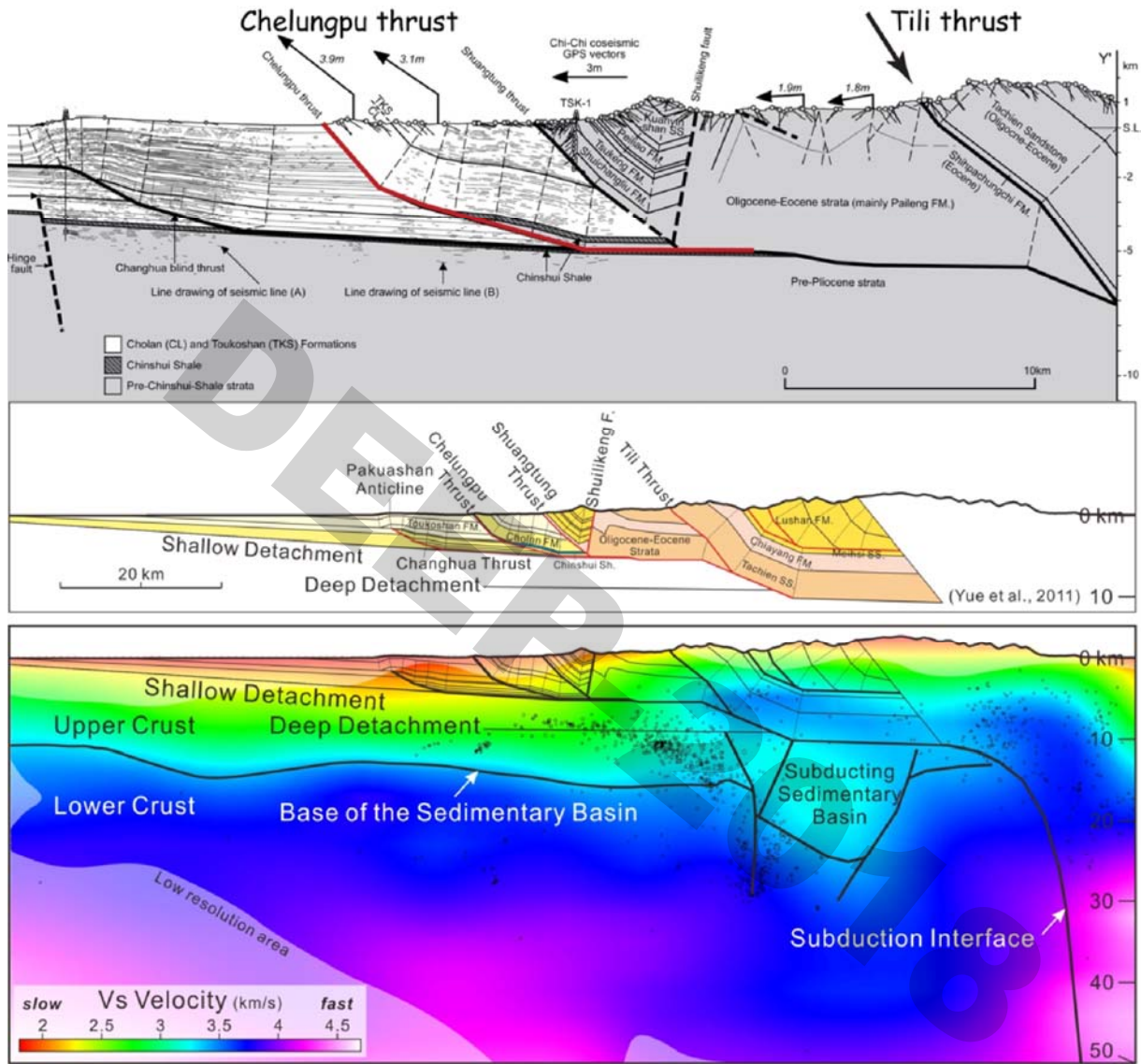
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Taiwan is currently the fastest convergent arc-continent collision on Earth (~90mm/y) with 30-40mm/y classic subduction of the Eurasian lithosphere and 50-60mm/y secondary subduction of forearc and arc lithosphere of the Philippine-Sea plate. We present a set of multi-scale geophysical/geologic transects across the oblique transition of the Eurasian plate boundary from continental rise to shelf subduction. The multi-scale transects extend from the surface to ~400km depth, using high-resolution local and regional tomography, OBS data and well-located seismicity to define the deep crustal and lithospheric structure, whereas surface geology and petroleum data, high-resolution bathymetry, PSDM seismic reflection data, local tomography, OBS data, seismicity and geodesy are integrated to define uppermost crustal structures and kinematics above the subduction interfaces (5-10km depth).

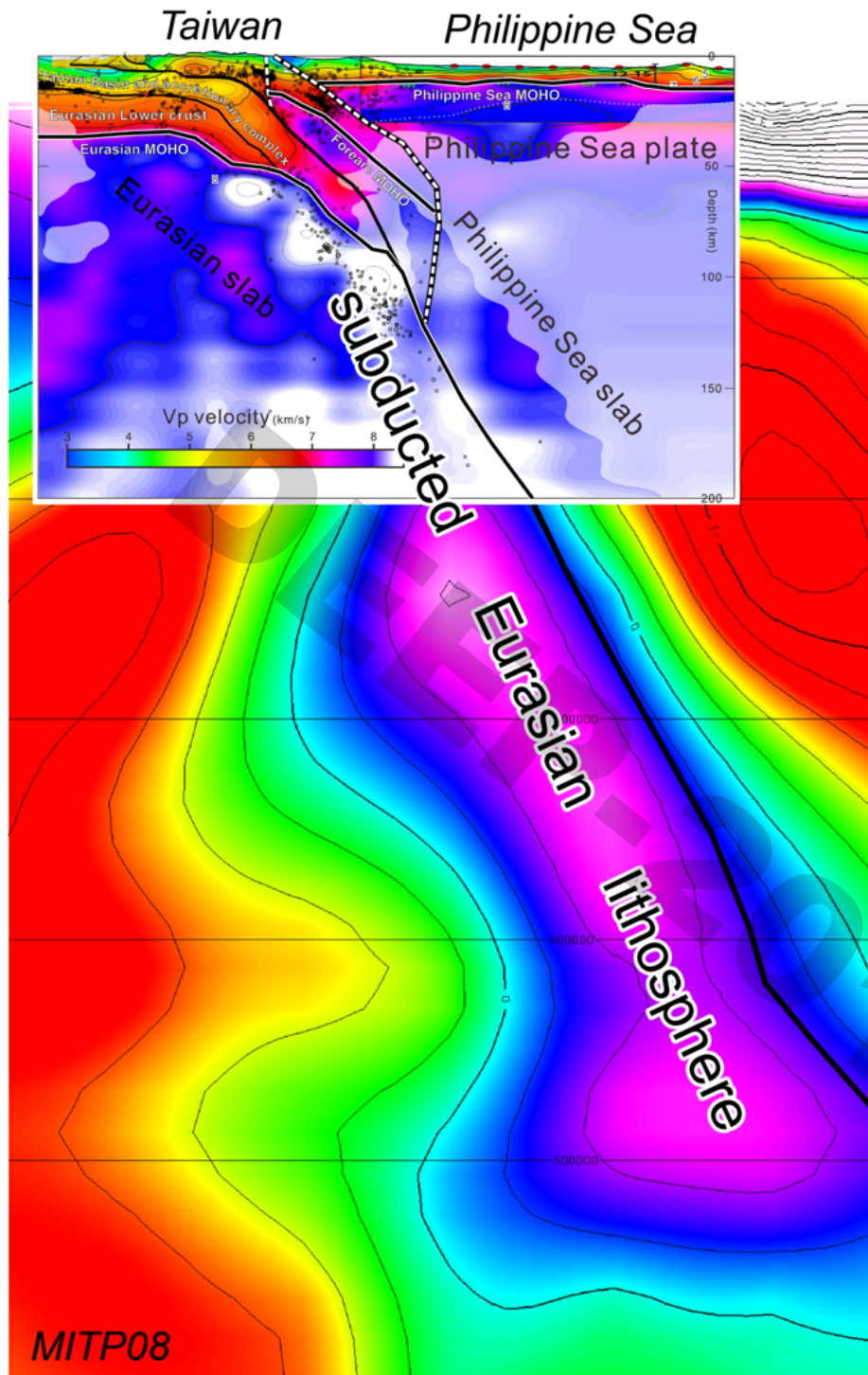
On the Eurasian plate, the uppermost sedimentary basins are shortening and deforming as a largely west-vergent fold-and-thrust belt that roots into the 5-10km deep thin-skinned detachment of the Eurasian subduction interface, whereas the lower sediment basins, lower crust and mantle lithosphere are subducting under the accretionary complex of the Taiwan mountain belt and Manila trench. The subduction interface below the metamorphic rocks of the Taiwan Central Mountains and Hengchun ridge is imaged tomographically as a widespread velocity inversion at ~10km depth, locally illuminated by seismicity (**Figure 1**). Subducted Eurasian lithosphere is imaged tomographically extending to the mantle transition zone, with Benioff-zone seismicity extending to ~300km depth, but only within transitional oceanic mantle lithosphere.

On the Philippine Sea plate, the shallow parts of the Luzon trough fore-arc basin, the Luzon arc and the Huatung Basin to the east are shortening as a thin-skinned retro-wedge fold-and-thrust belt with bivergent thrusting above a shallow ~5km detachment, currently consuming ~60mm/y. Deeper lithosphere of the Luzon forearc and arc is subducting eastward with the same polarity as the Eurasian subduction, as first proposed by Chemenda and now imaged tomographically to at least ~90km depth (**Figure 2**). This transient subduction, which accounts for ~125 km collapse of the fore-arc, Luzon Arc and Huatung Basin

of the western edge of the Philippine-Sea plate, is associated with a change in motion of the Philippine Sea Plate ~2Ma. The subduction rate of Eurasian lithosphere has remained at ~30mm/y since about 15Ma.



**Figure 1.** Multiscale constraints on the shallow-to-deep structure of the central Taiwan mountain belt in the vicinity of the 1999 Chi-Chi earthquake. Note that the upper crustal retro-deformable structural interpretation of shallow data was produced before that tomographic imaging. The observed tomographic velocity inversion across the subduction interface ( ~11km depth) confirms the previous upper crustal retro-deformable interpretation.



**Figure 2.** Multiscale constraints on the shallow-to-deep structure of the southern Taiwan mountain belt in the vicinity of the 2016 Meinong earthquake. Note that the deeper parts (>4-10km of the deep Tainan continental margin basin (18-22km deep) is subducting. The same velocity inversion across the ~11km deep subduction interface shown in dVs in **Figure 1** is illustrated in Vp in this case.

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