Active dehydration, detachment and flow of transitional continental crust in an arc-continent collision, Taiwan

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Integration of recent Vp and Vs tomographic models (Huang et al., 2014) with recently recognized mid- to lower-crustal tremors (Chuang et al., 2014), a near-vertical zone of high conductivity (Bertrand et al., 2012) and He isotope ratios collected from groundwaters (Chen et al., this meeting, 2017) in southern Taiwan suggests that stretched continental crust is detached from the subducting mantle of the Eurasia plate during the early stages of the arc-continent collision in Taiwan. In southern Taiwan, vertical sections of the tomographic models show an east-dipping, asymmetric lobe of low P-wave velocity, probably stretched continental crust, projecting down dip to a band of seismicity interpreted as the Wadati-Benioff zone of the subducting Eurasian plate. Approximately 20 km to the north, the Wadati-Benioff zone is absent and the east-dipping lobe appears to have separated, forming two shallower, sub-vertical lobes separated by a band of seismic tremors and a cylindrical-shaped zone of high conductivity. The tremors and the zone of high conductivity extend to nearly 40 km, which is close to the crust-mantle boundary in this area. Chuang et al. (2014) proposed that the tremors represent a zone of deformation and dehydration associated with prograde metamorphism as the low-velocity crust was progressively subducted. The sub-vertical zone of high conductivity is consistent with this interpretation. He isotope ratios of groundwaters, rock outcrops and hot springs collected along the Tulunwang fault show significant mantle contamination (Chen et al., this meeting, 2017). We propose that the Tulunwant fault projects down dip to the east to the zone of tremors, defining a crustal-scale shear zone that accommodates initial detachment of at least the middle and upper crust from the subducting Eurasian lithosphere.

Distinctively out-of-phase 7.5 and 6.5 km/sec isovelocity surfaces also suggest separation of the middle and upper crust from the subducting lithosphere. For example, the 7.5 km/sec surface, approximately the bottom of the lower crust (or Moho), forms a broad, smooth synformal structure that trends north parallel to the bend of the subducting Eurasian lithosphere. In contrast, the 6.5 km/sec surface shows higher amplitude, shorter wavelength undulations that trend northeast, parallel to the structural and topographic grain of the collision. The subsurface form of the 6.5 km/sec surface also correlates positively with the surface topography whereas the 7.5 km/sec surface shows a negative correlation, consistent with flow and mobility of the middle and lower crust in an arc-continent collision.

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