MG02

Milestones in arc-continent collision evolution: The transition from intra-oceanic subduction to incipient collision

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Two tomographic velocity models, T1 (south) and T2 (north), extend east-west across the Manila subduction zone into the northern South China Sea Basin (SCS) to reveal deep crustal structure in the incipient collision setting of the Taiwan arc-continent collision. Data were acquired offshore southern Taiwan in 2009 as part of the TAIGER program. The area between Taiwan and Luzon represents a transition from a tectonic regime dominated by eastward subduction of oceanic crust of the SCS near Luzon to one dominated by subduction and eventual collision of rifted Chinese continental crust with the North Luzon Arc culminating in the Taiwan orogeny. Due to the oblique nature of plate convergence, collision propagates south through time. One of the keys to obtaining a complete geodynamic understanding of the Taiwan arc-continent collision is to document the crustal structure in the incipient collision zone offshore southern Taiwan. In this area we acquired two wide-angle seismic datasets using 30 OBS's spread over ~480 km along the northernmost transect T2, and 18 OBSs spread over ~280 km along the southernmost transect T1. Data quality is extremely variable due to complex geological structure and quality of seafloor coupling at each instrument. Although the velocity structure of the Chinese continental margin has been well documented in this region by previous tomographic studies, the new data constrain the velocity structure and ocean ward extent and thickness of the thinned continental crust entering the Manila trench along both transects. These models also illuminate several interesting structures of significance including what appears to be a high velocity body (5-6.5 km/sec) at the base of the accretionary prism along transect T2 that suggests arc-continent collision is preceded by the accretion (structural underplating) of blocks of continental material into the prism. Along the southern transect T1, we observe the accretionary prism to be composed of material with lower seismic velocity (3-4.5 km/sec) indicating the prism here is primarily composed of sedimentary material with no evidence of basement accretion as observed along T2 to the north. We also constrain the prism ward extent and geometry of the forearc block along transect T1 that appears to be a very abrupt, near vertical boundary dissimilar to the wedge shape described by earlier studies and may be a relic clue to the mechanism of subduction initiation along the Manila subduction zone.

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