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Rift Structure and Distribution of Magmatic Activity of the Southern Chinese Continental Margin Offshore Southern Taiwan from Reflection Imaging, Travel-time Tomography and 1D Thermal Modeling

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We present new multi-channel seismic reflection images and a travel-time tomography velocity model from offshore southern Taiwan that delineates the rift architecture and spatial distribution of magmatic bodies across the southern Chinese continental margin in the northeastern South China Sea. The timing and distribution of magmatic activity is an important component of rift systems that may control the development of rift structures and sediment deposition. The main structural features in these data include ~3-4 km of passive margin strata deposited on moderately extended continental crust along the continental shelf, and a broad zone of hyper-extended and intruded continental crust across the continental slope and deeper basin. Crust rapidly thins from over 20 km along the continental shelf to less than 4 km at the base of the continental slope in a failed rift characterized by a shoaling Moho, tilted fault blocks and up to ~6 km of sedimentary strata. Outboard of this zone, crust is ~12-15 km thick and characterized by a velocity structure consistent with magmatically-modified thinned continental crust observed in the southwest and central Chinese margin, but incompatible with the velocity structure of ocean crust.

We observe numerous volcanic bodies throughout this transitional crust, including a high-velocity (~6.9 – 7.5 km/s) lower crustal layer ~3-5 km thick that is frequently interpreted as magmatic underplating possibly emplaced during rifting. However, the volcanic bodies we observe deform overlying post-rift strata, and numerous sills occur throughout the post-rift sedimentary section indicating post-rift magmatic activity. We find little additional evidence for extrusive syn-rift volcanism, such as seaward-dipping reflectors. We compare these observations to estimates of melt production from a 1D thermal model of pure shear rifting to provide further insights into the interplay between extension and magmatism during rifting.

Keywords: marine geophysics, rifted margins