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The Crustal Structure of the Northern South China Sea continental margin revealed by Multi-Channel Seismic Reflection and Ocean Bottom Seismometer Observations

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The South China Sea (SCS) is an ideal place to examine the nature of continental rifting, break-up, and the onset of seafloor spreading. Being mostly inactive today, the SCS basin is measured to get spreading in the early Oligocene and to generate a series of syn-rift structures on the margins, therefore, to know the crustal structures of continental margin can help us to understand the evolution of the SCS. In this study, we use multi-channel seismic (MCS) reflection data to reveal the upper crustal structures and ocean bottom seismometer (OBS) data to probe the lower crustal structures. Accompanying the MCS experiments with active sources, 39 OBS stations were deployed along 2 NW-SE trending profiles in the northern SCS. The eastern profile is located southeast of Dongsha atoll, while the western profile extends from the Zhu II depression to the NW sub-basin of SCS. For construction crustal velocity models, we extract shallow velocity structure from the MCS profile data, then we conduct travel-time tomographic inversion on OBS data to derive 2D velocity models. Finally, forward modeling using RAYINVR is subsequently applied to refine the velocity models. Both MCS profiles show that the basement has been offset by normal faults and thick sediments are deposited in the grabens. Many volcanic bodies are observed in the eastern profile, but few appear in the western profile. The OBS velocity model of the eastern profile reveals that the crustal thickness decreases gradually toward the oceanic basin. However the continental crust thins abruptly from continental slope toward the NW sub-basin. A high velocity layer (>7km/s) in the lower crust can be identified in the eastern profile, but not in the western profile. This high velocity layer has been interpreted to be underplating material, however, another possibility is that it might be serpentinized upper mantle, which frequently found in necking zones and COTs zones.