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Crustal Structure and Fracture Zone in the Central Sea Basin of the South China Sea from Wide Angle Seismic Experiments Using OBS

Aiguo Ruan and Xiaodong Wei
Second Institute of Oceanography, SOA, Hangzhou, China (ruanag@163.com)

We present two E-W trending wide-angle seismic profiles (OBS2013-ZN, OBS2014-ZN), which cross the boundary (Zhongnan fault) between the east sub-basin and the southwest sub-basin of the South China Sea (SCS). We processed the data and used 2D ray-tracing to determine the oceanic crust thickness, velocity structures and Moho depth variations related to faults. The simulated velocity models show that the sea basin of the SCS has a typical oceanic crust covered by a 1∼2 km thick sediment layer with a velocity of 2∼3.5 km/s. The crust has a thickness of 5∼8 km, of which the oceanic layer 2 is 1.8∼3 km thick, with velocity increasing downward from 4.3 km/s to 6.4 km/s, and the oceanic layer 3 is 3∼5 km thick, with velocity increasing downward from 6.4 km/s∼7.0 km/s. The sea basin Moho depth is approximately 10 km. The Moho discontinuity has an obvious upheaval zone with a low velocity of 7.6 km/s, which corresponds to the low velocity zone in oceanic layer 2. We constructed an arc-shaped fracture zone (40-50 km wide) by connecting the upheaval portions of the Moho in the two profiles based on seabed relief and sea mounts distribution and suggest that it is the trace of the break-up of the Macclesfield and Reed Banks caused by the triangular opening system of the southwest sub-basin. We suggest that the faults or fracture zones in the oceanic basin of the SCS were formed in segmentation with varied directions controlled by varied stress fields during the multi-episode evolution of the SCS. The seafloor spreading abrupt direction change around 116°E maybe is because of lithosphere heterogeneity caused by early episode seafloor spreading in the east sub-basin or caused by the arc-shaped fracture zone, which results in different local stress filed.