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Crustal structure from offshore wide-angle seismic data: Application to South Yellow Sea

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South Yellow Sea was a component of the circum-Pacific continental margin active belt, developing on the marine basement during pre-Paleozoic and mid-Paleozoic. The lack of detail in the offshore seismic model in the crustal levels means that the deep structure remains ambiguous. We processed the offshore wide-angle seismic data from 30 sections that were acquired in 2013 in order to achieve a continuous 2-D velocity and interface model using Rayinvr. The final velocity/interface model along the survey lineshows significant horizontal and vertical variations. The moho depth achieved in this paper (32-36 km) is consistent with those from previous studies, without a root. Two faults mark the gradient locations in the velocity and the changes in the interfaces that separate this high-velocity anomaly from low-velocity bodies. The three velocity bodies correlate well with the regional geological structures (Qianliyan Uplift, Northern Depression, Central Uplift) that are projected onto our model.

Beneath the Northern Depression, the Permian and Triassic strata such as the Qinglong Formation are denuded on a large scale combining velocity model and multi-channel seismic data. Jurassic and Cretaceous strata rest unconformably on the marine residual strata in the Mesozoic and Paleozoic. However, the Triassic strata (Qinglong Formation) and Permian strata (Dalong and Longtan Formations) are preserved in the Central Uplift. In other words, the uplift and denudation in the orogeny generally appear stronger in the north than in the south.

Previous geological and geophysical studies have suggested that abundant normal faults with NE-SW trend played an important role in the tectonic evolution of the South Yellow Sea. More specifically, investigations reveal that the Jiashan-Xiangshui-Qianliyan fault is the boundary between the Qianliyan Uplift and Northern Depression in the sedimentary formations. We suggest that normal faults terminate at the upper crust after passing through the sedimentary layers. Marked velocity changes and interface fluctuations are observed in the middle and lower crust beneath the northern South Yellow Sea, where we infer a NW-dipping fault. In other words, the deep NW-dipping fault is the deep footprint of fault system in the South Yellow Sea and appears a normal fault from the velocity feature. This finding indicates that shallow faults in the northern South Yellow Sea could converge towards the deeper crust.