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

Weina Zhao, Zhiqiang Wu, Xunhua Zhang

(ouczwn@163.com)

Northwestern Polytechnical University, Qingdao Research Institute, China
Qingdao Institute of Marine Geology, China
The South Yellow Sea (SYS) basin, situated between Shandong and Korean peninsulas.

The collision between the North China Block (NCB) and the South China Block (SCB) during the Triassic formed one of the most extensive ultra-high-pressure (UHP) metamorphic belts worldwide, which was located at the north of the SYS.

The sedimentary basin was filled with Cenozoic-Mesozoic continental sediments overlying the Pre-Paleozoic and Mesozoic-Paleozoic marine sediments.
The lack of detail in the offshore seismic model in the crustal levels means that the deep boundaries of the Northern Sulu Orogen and internal geotectonic setting of the basin in the SYS remain ambiguous.

Hao et al., 2003: **29km** (from Gravity inversion)

Wang et al., 2013: **30-33km** (from Gravity and Magnetic inversion)

Qi, 2015: **30-35km** (from wide-angle seismic data inversion)
Location of survey line for the velocity model in this study

NCB, North China Block; YB, Yangtze Block; SL, Sulu Orogen; JDP, Jiaodong Peninsula; JLB, Jiaolai basin; SYS, South Yellow Sea; QU-SYS, Qianliyan Uplift of SYS; NB-SYS, Northern Depression of SYS; CU-SYS, Central Uplift of SYS; SB-SYS, Southern Depression of SYS; F1, Tanlu Fault; F2, Wulian-Qingdao-Yantai Fault; F3, Qingdao-Rongcheng Fault; F4, Fault in QU; F5, Jiashan-Xiangshui-Qianliyan Fault; obs01-obs37, OBS stations.

Table 1 Sensor parameters of the survey line

<table>
<thead>
<tr>
<th>Region</th>
<th>Offshore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>MicroOBS</td>
</tr>
<tr>
<td>Working frequency</td>
<td>4.5Hz~200Hz</td>
</tr>
<tr>
<td>samples per second</td>
<td>250</td>
</tr>
</tbody>
</table>

Table 2 Observation parameters of the survey line

<table>
<thead>
<tr>
<th>Sea area</th>
<th>Length (km)</th>
<th>Receivers</th>
<th>Receiver spacing (km)</th>
<th>Shots</th>
<th>Shot energy</th>
<th>Shot spacing (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>326</td>
<td>39</td>
<td>6</td>
<td>2501</td>
<td>6060</td>
<td>inch³</td>
<td>0.125</td>
</tr>
</tbody>
</table>
(a) Seismic record section at a reduction velocity of 6 km/s.

(b) Ray coverage in the final model. Different colors indicate different ray types.

(c) Observed travel-times (colors) and modelled travel-times (black dots).

Pg is a base refraction wave with strong energy and good continuity, which is tracked continuously onshore and in the Qianliyan Uplift. Ps denotes shorter basement refraction waves in continental basins of the South Yellow Sea, as recognized in the near offset channels of the OBS stations. P1 and P2 indicate reflected waves from the internal interfaces of the upper crust, which are missing in some gathers. P1s and P2s, which is the refractive wave in the upper and middle crust, respectively, mainly appears in the southern part of the survey line. PcP represents a reflected wave from the upper interface of the lower crust. PmP is a Moho reflection wave with strong energy and good continuity. Pn denotes rays refracted in the upper mantle.
Conclusions

• The moho depth achieved in this paper (32-36 km) is consistent with those from previous studies, without a root.

• The uplift and denudation in the orogeny generally appear stronger in the north than in the south.

• The deep NW-dipping fault (F) is the deep footprint of fault system in the South Yellow Sea and appears a normal fault from the velocity feature. Shallow faults in the northern South Yellow Sea could converge towards the deeper crust.