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Deep seismic reflection profile with big-size dynamite shots reveals Moho and mantle reflection: tracking continental evolution

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The deep structure of orogenic belts and cratons has become an important part to track evolution and innovation of tectonics. The extremely thick crust and overlying deposition bring obstacles to the deep structure of the orogenic belt and ancient block. Deep seismic reflection profile is globally regarded as an advanced technology to perspective the fine structure of the crust and the top of the upper mantle, especially using large-size dynamite shots. In the 1990s, international scholars used deep seismic reflection profiles to find inclined reflections penetrating from the lower crust to the upper mantle (Calvert et al., 1995; Cook et al., 1999). They believe that these reflections are related to ancient subduction events(or fossil subduction). At the beginning of this century, Chinese scholars began to carry out similar experiments in the Tibet Plateau, Sichuan Basin and Songliao basin. Using big-size dynamite shots, they also found the Moho under the extremely thick crust of the Tibet Plateau and the mantle reflection under the ancient block (Gao et al., 2013, 2016; Zhang et al., 2015). In 2016, with the support of China Geological Survey Project,we arranged a seismic reflection profile around the Scientific Deep Drilling SK-2 Well in the middle of Songliao basin. According to the data processing results of all five big-size dynamite shots and four medium-size dynamite shots of the profile, we obtained a 127.3km long single-fold reflection profile, revealing the reflection characteristics of the lower crust, Moho and its upper mantle in the study area. The Moho structure distributed nearly horizontally at a depth of 33km (estimated by the average crustal velocity of 6km/s) is clearly obtained, and the mantle reflection extending obliquely from Moho to 80km-depth is found. We believe that this dipping mantle reflection represents an ancient subduction relic under the Songnen block.

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