

Imaging the crustal architecture of the South China Block by SinoProbe seismic profiling

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A seismic-reflection profile traversing the South China Block in an east-west direction clearly images the crustal architecture of the Yangtze and Cathaysia blocks. Interpretations of this seismic profile lead to the following first-order observations. (1) The Yangtze Fold zone bounded in the east by the Xuefengshan orogenic belt is characterized by strongly folded and truncated reflectors in the upper crust, which correspond to thin- and thick-skinned thrust systems associated with large-scale intraplate structural imbrication and shortening in the northwest Yangtze region. It constitutes a retro-arc foreland system developing far away (>800 km) from the convergent margin. The Sichuan Basin itself is characterized by flat-lying reflectors of Neoproterozoic to Jurassic sedimentary sequences, indicating a stable cratonic basement. (2) A prominent character revealed by this profile is a strong reflector zone buried beneath the Neoproterozoic sequence across a wide area in Wuling Shan and Xuefeng Shan. This buried zone has been interpreted as an orogen that welded together the Yangtze and Cathaysia blocks in the late Paleoproterozoic. (3) The deep structure beneath the Cathaysia block is largely complicated by voluminously exposed magmatic rocks in this region. The Moho seems to be flat but extends discontinuously, interrupted by oblique reflectors. Two distinct terranes separated by the Zhenghe-Dapu fault zone can be distinguished in SE China. The Wuyishan terrane is highly reflective and shows truncated and folded reflectors that document extensive crustal shortening and high-strain deformation; the coastal terrane is low-reflective with the exception of several strong bands of layered reflectors, possibly related to an extension-related crustal architecture dominated by voluminous magmatism. Overall the above-stated deep seismic profiling observations show that a wide retro-arc foreland system developed in South China during the westward subduction of the paleo-Pacific oceanic plate in the Jurassic, and the Cathaysia block underwent significant extensional overprinting in the Cretaceous. As a consequence, the crustal thickness varies progressively from 40~45 km below the Sichuan basin and the Yangtze Folded zone to ~33 km below the Cathaysia block and less than 30 km in the Coastal zone. Rough estimates suggests ~7 km crustal thinning of the Cathaysia block, which is much lower than known for typical crustal extensional areas. It is likely that the large volume of magma underplating to the crust, due to asthenospheric upwelling, may have compensated for some of the expected crustal thinning during crustal extension.