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Three dimensional velocity and Poisson's ratio structures beneath eastern-central China and implication for deep geodynamics

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There exist a mineralization zone in the middle and lower Yangtze region and an ultra-high pressure metamorphic belt in the Qinling-Dabie-Sulu Orogenic belt, and both locate in the eastern-central China. Previous studies have shown that both might be caused by the rich exhalation of magma during the Mesozoic period, but various geodynamic models for explaining the mechanism of the Cretaceous magmatism are controversial and even contradictory. A unified geodynamic model is required for understanding the magmatism in eastern-central China. We have applied the teleseismic tomography method to determine a 3-D P- and S-wave velocity model and their corresponding Poisson's ratio structure of the mantle down to 700 km depth beneath this region by using 32,803 P- and 12,627 S-wave relative residuals of travel times collected from 564 teleseismic events recorded at 73 portable and 154 static seismic stations. All relative residuals were calculated by using the multi-channel cross-correlation method that makes the data precision up to less than 0.1 second. The optimal grid space in horizontal is chosen as 1°×1° and 50-100 km in deep. Our tomographic results show that there exist strong coherences between P- and S-wave velocity anomalies in most regions. The primary features in the plan views of velocity tomography are that (1) lower velocity anomalies exist at depths from 200 to 300 km beneath the lower Yangtze Block and extend southward down to 700 km beneath the Cathaysia Block, and (2) higher anomalies extend down to 500 km from 50 km beneath the middle Yangtze Block to the south of the Dabie Orogen Belt which represents a stable craton, and (3) another high velocities appear at 500-700 km depths beneath the lower Yangtze Block which is explained as the stagnant Paleo-Pacific plate in the mantle transition zone. In the plan views of Poisson's ratio, the results show that the corresponding Poisson's ratio to lower velocity is higher at 50-300 km and lower at 400-600 km in depth, respectively. In general, low velocity and high Poisson's ratio represent the silicate melt, however, low velocity and low Poisson's ratio represent the water. In our study, the low velocity at 200-300 km beneath the lower Yangtze Block therefore might be partial melt, like a magma, relating to the mineralization in the middle-lower Yangtze river and the low velocity at 400-600 km beneath the Cathaysia Block might be caused by the water with unknown source. Combining our tomographic images with previous geological, geochemical and geophysical results, we propose a double-slab subduction model to explain the deep geodynamics and consider that the Paleo-Pacific Plate subduction played a key role in not only the formation of igneous rocks in the lower Yangtze

Block but also remelting of the subducted South China Block beneath the Dabie Orogon during 135-101 Ma.