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Early-Paleozoic structural features and tectonic evolution of the eastern part of the northern boundary of the Proto-Tethys Ocean

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The North Qinling Terrane (NQT), including the Kuanping, Erlangping and Qinling groups, is located in the northern part of the Qinling Orogen, and is a key area to evaluate the tectonic evolution of the northern boundary of the Proto-Tethys Ocean. Based on (1) detailed structural analyses of different units within the NQT and the southern margin of the North China Block, (2) metamorphic age data of the NQT and (3) detrital zircon U-Pb age analytical results from the NQT and surrounding regions, this study reveals the subduction-collision-exhumation process of the Kuanping Ocean.

Three episodes of deformation (D_1, D_2 and D_3) are recognized in the study area. The D_1 deformation is characterized by NNE-SSW-dipping penetrative foliations (S_1), The D_2 deformation is marked by tight asymmetric folds with NNE-SSW-dipping axial plane foliations (S_2). The D_1 and D_2 deformations occurred during ~440-400 Ma, coinciding with the collision and exhumation of the NQT. These two deformations are overprinted by the D_3 deformation characterized by ENE-trending upright open folds and widely distributed kind bands.

The Kuanping Ocean is a big ocean existing during the Mesoproterozoic-Early Paleozoic. The ancient suture zone representing the closure of the Kuanping Ocean is the Luonan-Luanchuan Fault. Huge differences existing on either side of this fault are more significant than those for the

Shangdan Suture Zone, which suggests that the Luannan-Luanchuan Fault marks the northern boundary of the Proto-Tethys Ocean in the study area.

The existence of the passive margin depositional system in the southern North China Block indicates the southward subduction of the Kuanping Ocean. The north-vergent major faults and axial plane foliations, and the high-pressure eclogites and granulites located in the northern and southern part of the NQT, respectively, also suggest that the Kuanping Ocean subducted southward beneath the NQT.

Detrital zircon U-Pb age data show that the age spectrum for the Kuanping Group with the youngest zircon at ~640 Ma is quite different from the ages recorded for the southern margin of the North China Block, while the age spectrum with the youngest zircon at ~510 Ma is similar to both the NQT and the southern margin of the North China Block. This suggests that the Kuanping Ocean subducted southward continuously during the Neoproterozoic to Early Paleozoic interval, with final closure in the early Paleozoic.

References:

[1] Zhao SJ et al. (2015) J Asian Earth Sci 113:560-574.