Indentation tectonics of the Zhongtiaoshan Block in the Trans-North China Orogen

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The North China (NCC) is one of the oldest cratons in the world. The tectonic evolution processes of the NCC have been debated for decades (Zhao and Zhai, 2013; Zhao, 2007; Zhao et al., 2002, 2003, 2005, 2009; Zhai et al., 2005; Zhai and Santosh, 2011; Wilde et al., 2002, 2005; Kroner et al., 2005; Kusky et al., 2001, 2007; Kusky and Li, 2003; Faure et al., 2007; Trap et al., 2012; Hu et al., 2013; Zhao et al., 2019). The controversy focuses on the time of the formation of the NCC is in the late Paleoproterozoic or the late Archean. The key point of the controversy is that there are serious disagreement about the nature and implications of the late Paleoproterozoic orogen in the NCC. Some researchers thought the NCC underwent compression in 1.85 Ga according to previous researchers (Zhai et al., 2005; Zhai and Santosh, 2011; Zhao et al., 2019). Some researchers even thought that the NCC was finally formed resulted from the collision of the east block and the west block (Kusky et al., 2001, 2007; Kusky and Li, 2003; Trap et al., 2012; Zhao et al., 2002a, 2003a, 2005, 2009). Recently, we found that NE-NEE trending extensional ductile shear zones developed in the Paleoproterozoic granitic gneiss (2.4Ga) in the northern margin of the Zhongtiaoshan, the middle part of the NCC. The ductile shear zone was unconformity covered by the Changcheng System and the deformation ages according to the $^{40}$Ar/$^{39}$Ar dating results is 1.92 Ga, which indicate that the deformation time was in the late Paleoproterozoic. Therefore, We propose that that the NCC was in the post-collision extension environment or lateral and vertical extrusion of blocks might have happened after the orogeny in late Paleoproterozoic.