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Neoarchean ductile deformation in the Northeastern North China Craton: The Shuangshanzi ductile shear zone in Qinglong area, eastern Heibei, China

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Archean granitic gneiss domes and greenstone belts are well-preserved in eastern NCC, one of the oldest Archean terrains in the world. The Shuangshanzi ductile shear zone in Qinglong, eastern Hebei Province is located between an Archean granitic gneiss dome and a greenstone belt within an uplift in eastern NCC. Supracrustal rocks from the Neoarchean Shuangshanzi and Zhuzhangzi Groups were sheared, but some Archean granitic gneisses were also involved in the shearing along the eastern margin. In the southern part, the narrow NE-trending shear zone dips NW with dip angles of 40-60° and, in the northern part, the shear zone dips NWN with dip angles of 70-85°. Microstructural and EBSD fabric analyses suggest that the shear zone was developed at upper greenschist facies to lower amphibolite facies conditions with deformation temperatures of 400 to 550°C.LA-ICP-MS zircon U-Pb ages of mylonitized granitic rocks and undeformed quartz diorite cutting the shear zone suggest that the Shuangshanzi ductile shear zone was formed between 2550 Ma and 2452 Ma. Detailed kinematic studies of the shear zone show a clear sinistral shear sense with a slightly oblique-slip component in the northern part and a sinistral transtensional slip component in the southern part. It is therefore suggested that the shear zone was formed during the Anziling doming with respect to the down-slipping Neoarchean Shuangshanzi and Zhuzhangzi Groups. The difference in kinematics along the southern and the northern sections is interpreted to be caused by the doming with an uneven clockwise spiral rotation.
The BIF-rich supracrustal rocks have higher density than their neighboring granitic gneisses, and therefore can easily sink to form synclines by sagduction processes. The sagduction is mainly triggered by gravitational inversion of high density supracrustal rocks with respect to relatively light granitic gneisses within the dome. As a result, the gneisses synchronously moved upward. A shear zone was thus developed to accommodate the upward and downward movements. It is possible that such a tectonic model also applies to many Archean granite-greenstone terrains.

Keywords: Neoarchean tectonics, North China Craton, Ductile shear zone, Structural and microstructural analysis, EBSD fabric analysis