Structural evolution of a triclinic-type transpressional high strain zone and its role in exhuming the root of the Paleoproterozoic Trans-North China Orogen

Jian Zhang[1], Guochun Zhao[2], Min Sun[2], Sanzhong Li[3], Shuwen Liu[4], Chunjing Wei[4], Changqing Yin[1]

[1]Sun Yat-sen University, Guangzhou 510275, zhangjian@mail.sysu.edu.cn
[2]The University of Hong Kong, Hong Kong SAR
[3]Ocean University of China, Qingdao 266100
[4]Peking University, Beijing 100871

Exhumation of the lower crust (e.g., orogenic root) is one of the key topics in understanding the evolution of global orogenic belts. Numerous geological and geophysical investigations have been carried out in typical Phanerozoic continent-to-continent collisional orogens (e.g., Alps and Himalayas) and built various models. These well-constrained approaches and models can be also used to unravel the orogenic processes of the early Earth, in particular the Neoarchean to Paleoproterozoic eons.

The Trans-North China Orogen (TNCO) is a Paleoproterozoic orogen along which the Neoarchean Eastern and Western Blocks collided with each other to form the uniform basement of the North China Craton. Available data have shown that it is a typical continent-continent collisional orogen and constitutes an integrated orogenic profile including the lower, middle and upper crust. However, the mechanism of the exhumation process of the orogenic root (i.e., lower crust) is still poorly constrained. This study focuses on a detailed macro-to-micro structural analysis of the Zhujiafang ductile shear zone (DSZ), a crustal-scale tectonic boundary separating the northern high-pressure granulite (retrograded eclogite) bearing litho-tectonic unit from the southern medium-pressure granulite-bearing litho-tectonic unit of the Hengshan Complex, one of the largest exposures of the TNCO.

Field mapping shows that the dominant foliation, disregard of generations, changes from shallowly to steeply dipping as one approaches the center of the DSZ. In addition, the foliations gradually vary from NE-SW striking in both of the northern and southern Hengshan to E-W striking in the DSZ. Such a large-scale structure is essentially controlled by a phase of dextral shearing deformation during the formation of the TNCO. Kinematic analysis indicates that the nature of the Zhujiafang DSZ is a transpressional zone including sub-vertical and horizontal shear components. When considering the movement in a high-strain zone in real space and the trend of lineations, most structural data are consistent with a triclinic transpressional shear model. Such type of shearing deformation played an important kinematic role in exhuming the lower crust (i.e., orogenic root) to a shallow crustal level along the Zhujiafang DSZ.

Combined with available petrological and geochronological data, this study places new constraints on the tectonic nature and kinematic behavior of the Zhujifang DSZ and the integrated exhumation process of the orogenic root of the TNCO.

This study was financially supported by the NSFC Grant 41772214, Young 1000 Talent Grant 2016-67, 32020002.