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Structural and metamorphic constraints on Barrovian and high-temperature domains in the Chinese Altai, central Asia: implications for crustal thickening and doming in accretionary orogens

Jiang, Y.D.[1], Štípská, P.[2], Sun, M.[3], Schulmann, K.[2], Zhang, J.[4], Zhao, G.C.[3]

[1]State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China, jiangyingde@gmail.com
[2]Center for Lithospheric Research, Czech Geological Survey, 11821 Praha 1, Czech Republic
[3]Department of Earth Sciences, The University of Hong Kong, Pokfulam Road, Hong Kong
[4]School of Earth Science and Geological Engineering, Sun Yat-Sen University, Guangzhou 510275, China

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High-temperature/low-pressure metamorphic domains are spatially associated with Barrovian-facies metamorphic ones in the vast areas of the Central Asian Orogenic Belt (CAOB), and their tectono-thermal significance was not further investigated using modern metamorphic and petro-structural approaches. Traditionally, it was believed that these seemingly contrasting domains resulted from two different tectono-metamorphic events of different ages.

In the present study, we firstly present the conclusive constraints by linking the structural and micro-structural observation with metamorphic evolution on the tectonic evolution of the Chinese Altai, a typical high-grade core of the CAOB. we documented structural features and mineral growth sequences in both Barrovian-type and high-temperature/low-pressure domains. Subsequently, their respective *P–T–D* paths are established on the basis of micro-structural observations and pseudosection modelling, and the prograde and retrograde evolutions are proposed.

Our findings suggest that juxtaposition of Barrovian-type and high temperature domains was a consequence of two major episodes of deformation (D1 and D2). D1 is characterized by penetrative sub-horizontal fabric (S1) and D2 is marked by upright folds (F2) with NW-SE trending axial planes in shallow crustal levels and by sub-vertical transposition foliations (S2) in the high-grade cores of large scale F2 antiforms. Successive growth of biotite, garnet, staurolite and Kyanite is observed in the S1 fabric. In the biotite and garnet zones, the spaced S2 cleavage is marked by biotite and muscovite, and in the staurolite and kyanite zones, the penetrative S2 fabric is characterized by sillimanite, locally with late cordierite. Phase equilibria modeling indicates that the S1 fabric was associated with increase of pressure and temperature under Barrovian-type conditions in both domains. The S2 fabric was related to decompression, in which rocks in the biotite and garnet zones well preserve the peak assemblage and the higher grade rocks in the staurolite and kyanite zones reequilibrated to different degree under high-temperature/low-pressure (HT/LP) conditions. The D1 metamorphic history is attributed to the progressive burial related to Early-Middle Paleozoic crustal thickening and the metamorphism associated with D2 is interpreted to result from exhumation by vertical extrusion. The extrusion of hot rocks was contemporaneous with the formation of migmatite domes accompanied by the intrusion of magmas at middle crustal levels during the Middle Paleozoic. Consequently, there is a genetic link between the Barrovian-type and high-temperature domains related to continuous transition of the Barrovian-type fabric into the HT/LP one during development of domal structures in the southern Altai

orogenic belt. The mobilization of anatectic deep crust to higher structural levels yield important insights on dome dynamics in orogens.

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