
An early Paleozoic Subduction Channel in the North Qilian Mountains, Northwestern China: Structural, Petrological and Chronological Constraints

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Abstract

Detailed geological mapping, structural, petrological and chronological investigation allow us to place new constraints on the tectono-thermal evolution of the North Qilian high pressure/low temperature (HP/LT) metamorphic belt. The North Qilian HP/LT metamorphic belt mainly consists of eclogite, blueschist, metasedimentary rocks and serpentinite. Most of eclogites and mafic blueschists occur as lenses within metasedimentary rocks, and minor eclogites within serpentinite. Petrological and geochemical data indicate that the protoliths of eclogite and mafic blueschist includes E-, N-MORB, OIB and arc basalt. Geochronology and Lu-Hf isotope of detrital zircons from metasedimentary rocks indicate the detritus materials are derived from Qilian block and likely deposit in continental margin or fore-arc basin. Zircon U-Pb datings show that the protolith ages of eclogites vary between 500 Ma and 530 Ma, and the metamorphic age of eclogite between 460 and 489 Ma. The detrital zircon ages of metasedimentary rocks distribute between 532 and 2700 Ma. The structural data show that the deformation related to the subduction during prograde is recorded in eclogite blocks. In contrast, the dominant deformation structures are characterized by tight fold, sheath fold and penetrative foliation and lineation, which are recorded in various rocks, reflecting a top-to-the-south shear sense and representing the deformation related to the exhumation. The petrological data suggest that the different rocks in the North Qilian HP/LT metamorphic belt equilibrated at different peak metamorphic conditions and recorded different P-T path. Synthesizing the structural, petrological, geochemical and geochronological data suggest a subduction channel model related to oceanic subduction during Paleozoic in the North Qilian Mountains. The different HP/LT metamorphic rocks formed in different settings with various protolith ages were carried by the subducted oceanic crust into different depth in subduction channel, and experienced independent tectono-thermal evolution inside subduction channel. The North Qilian HP/LT mélange reflects a fossil oceanic subduction channel.

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