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A Cold Early Paleozoic Subduction Zone in the North Qilian Mountains, NW China: Petrological and Chronological Constraints

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The North Qilian HP/LT metamorphic belt is composed mainly of blueschist, eclogite and greenschist facies rocks. It formed within an early Paleozoic accretionary wedge associated with the subduction of the oceanic crust and is considered to be one of the best preserved HP/LT metamorphic belts in China. Here we report some new lawsonite-bearing eclogitic rocks enclosed within blueschist in the North Qilian Mountains. Lawsonite coexists with omphacite and phengite as inclusion in garnet, indicating eclogite facies conditions garnet growth. Peak pressure conditions estimated from lawsonite-omphacite-phengite-garnet assemblages were 2.1-2.4 GPa at temperature of 420-500°C, being in or near the stability field of lawsonite eclogite facies, and implying formation under a geotherm of 6-8°C/km. The low value is consistent with metamorphism in a cold subduction. SHRIMP U-Pb dates for zircons from two lawsonite-bearing eclogites yields ages of 489 ± 7 Ma(mean of 11) and 483 ± 11 Ma(mean of 6), reprectively. CL images and minerals inclusions in zircons indicate these ages reflect eclogite-facies metamorphism. Ar-Ar ages of 455-460Ma for phengites in eclogite and blueschists were interpreted to represent blueschist-greenschist facies overprinting ages. In combination with the petrological and chronological data, a cold early Paleozoic subduction zone in the north Qilian Mountains is constrained.