

Cold subduction along circum-Gondwana evidenced by early Cambrian high pressure/low temperature metamorphism in the southeastern Tarim craton

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The circum-Gondwana subduction initiated by the early Cambrian has been considered to reflect the establishment of the modern plate tectonics in response to global plate re-organization due to the final assembly of Gondwana. Metamorphic rocks, especially blueschist and low temperature (LT) eclogite that form under high pressure (HP)/LT conditions with low thermobaric (T/P) ratios, as a hallmark of cold subduction in the modern tectonic regime have not been well investigated. To better understand the circum-Gondwana subduction and to test its possible link with the emergence of the modern plate tectonics, this study focused on blueschist-facies metamorphic rocks in the Altyn Tagh of the southeastern Tarim craton.

Mineral assemblage and chemistry indicate that the zoisite blueschist and glaucophane (Gln)-bearing quartz schist samples have blueschist-facies mineral assemblages. Phase equilibrium modelling and quartz-in-garnet Raman elastic geobarometry reveal that the studied samples experienced lawsonite to epidote blueschist-facies metamorphism at 520-545 °C and 16-19 kbar, representing HP/LT metamorphism with low T/P ratios of <300 °C/GPa. These blueschist-facies metamorphic rocks underwent rapid decompression due to exhumation starting at P-T conditions of <495 °C and <9.6 kbar. Ar-Ar geochronological results record paragonite Ar-Ar plateau ages of 520-506 Ma for the zoisite blueschist samples and phengite Ar-Ar plateau ages of 522-516 Ma for the Gln-bearing quartz schist samples. It is suggested that the peak HP/LT metamorphism occurred prior to ca. 522 Ma. Based on new results and available data from the major Gondwana blocks, cold subduction is suggested to have initiated by the early Cambrian along circum-Gondwana after the amalgamation of Gondwana. The intense circum-Gondwana subduction probably represents the earliest global, cold subduction in Earth's history indicative of the establishment of the modern plate tectonics, as evidenced by the studied early Cambrian HP/LT metamorphic rocks and a dramatic drop in the mean T/P of metamorphism since the early Paleozoic.

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