Archean blocks and their boundaries in the North China Craton: lithological, geochemical, structural and P-T path constraints and tectonic evolution

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Abstract

An examination of lithological, geochemical, geochronological, structural and metamorphic P-T path data suggests that the basement of the North China Craton can be divided into Eastern and Western Blocks, separated by major crustal boundaries that roughly correspond with the limits of a 300 km wide zone, called the Trans-North China Orogen. The Eastern Block consists predominantly of Late Archean domiform tonalitic-trondhjemitic- granodioritic (TTG) batholiths surrounded by anastomosing networks and linear belts of open to tight synforms of minor volcanic and sedimentary rocks metamorphosed from greenschist to granulite facies at ~2.5 Ga, with anticlockwise P-T paths. Some Early to Middle Archean rocks are locally present in the Eastern Block, but their tectonic history is unclear due to reworking by the 2.5 Ga tectonothermal event. The Western Block has a Late Archean assemblage, structural style and metamorphic history similar to that of the Eastern Block, but it differs in the absence of early to middle Archean assemblages and in being overlain by and interleaved with Paleoproterozoic khondalites, which were affected by a ~1.8 Ga metamorphic event involving clockwise P-T paths. A mantle plume model is proposed for the formation and evolution of late Archean basement rocks in the Eastern and Western Blocks based on a combination of extensive exposure of TTG gneisses, affinities of mafic rocks to continental tholeiitic basalts, presence of voluminous komatiitic rocks, dominant diaprism-related domiform structures, anticlockwise P-T paths, and a short time span from the primary emplacement of TTG and ultramafic to mafic rocks until the onset of regional metamorphism. Between the two blocks is the Trans-North China Orogen which is bounded by two major fault systems and is composed of Late Archean to Paleoproterozoic TTG gneisses and granitoids, interleaved with abundant sedimentary and volcanic rocks that are geochemically interpreted as having developed in magmatic arc and intra-arc basin environments. These rocks underwent multiple phases of compressional deformation and peak high-pressure metamorphism followed by rapid exhumation during the Late Paleoproterozoic at ~1.8 Ga as a result of collision between the Eastern and Western Blocks, resulting in the amalgamation of the North China Craton.

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