Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.26524

UHT metamorphic event maybe earlier than ~1.92Ga in Huai'an complex, North China Craton

HAOZHENG WANG[1], LINFENG FENG[2] AND BYUNG CHOON LEE[1]

[1]Department of Earth and Environmental Sciences, Chonnam National University
[2]School of Geoscience and Technology, Southwest Petroleum University

Debates about the timing of the Paleoproterozoic ultrahigh-temperature (UHT) metamorphic event in the western block of North China Craton have generated diverse geological evolution models during the Paleoproterozoic. Garnet-sillimanite gneiss, a key rock type, is characterized by major minerals including garnet, sillimanite, alkali feldspar, plagioclase, and quartz. Garnet typically contains inclusions of quartz, sillimanite, biotite, and plagioclase at its core, while its rims often include rutile, monazite, and zircon. Petro-chronological studies were performed on rutile, monazite, and zircon from garnet-sillimanite gneisses within the Huai'an Complex. Rutile inclusions in garnet indicate a crystallization temperature of approximately 930–960°C and yield a weighted mean age of 1958 ± 14 Ma (N=4, MSWD=1.1). Monazite analyses reveal younger dates ranging from 1900 to 1930 Ma, with Gd_N/Yb_N ratios ranging from 1496 to 4685 that monazite age might be represent melt crystallization age after peak metamorphism. Metamorphic zircons exhibit two distinct age clusters at approximately 1.85 Ga and 1.95 Ga. Petrographic observations showing the coexistence of rutile, monazite, and zircon at garnet rims support interpreting the 1.96 Ga rutile age as corresponding to the UHT event. Additionally, trace element distributions in major accessory minerals and garnet further corroborate this interpretation.

Using Perple_X pseudosection modelling in the ZrMn-NCKFMASHT system, a peak assemblage of garnet, plagioclase, K-feldspar, sillimanite, quartz, melt, zircon, and rutile was identified to be stable at temperatures exceeding 900°C. Peak P-T conditions were estimated at 925–940°C and 10–12 kbar using isopleths of Zr-in-garnet, Zr-in-rutile, and An-in-plagioclase. Consistent temperature estimates were also obtained using the two-feldspar thermometer (applied to perthite and plagioclase) and the Ti-in-garnet thermometer. The peak metamorphic conditions are attributed to a slab-breakoff event, which introduced heat from upwelling asthenospheric mantle.

Based on these findings, it is proposed that the onset of the UHT event occurred earlier than previously thought (~1.92 Ga). Considering the documented high-pressure (~1.95 Ga) granulite-facies metamorphic history, the UHT event likely followed the HP event with a brief temporal gap. The previously reported younger age of ~1.92 Ga, often considered indicative of the UHT event, is now interpreted as representing a cooling phase instead.

Corresponding Email: leebc@chonnam.ac.kr