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The growth interval of garnet in the UHP eclogites from the Dabie orogen, China

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Abstract

Zircon inclusions, extracted from garnet from an ultrahigh-pressure eclogite in the eastern part of the Dabie orogen, were investigated with high spatial resolution U-Pb geochronology. The unzoned zircon rims have garnet and omphacite inclusions and show weak cathodoluminescence, low-Th/U ratios (0.02–0.18), flat high rare-earth elements patterns, and an absence of Eu anomalies, which suggest metamorphic growth in the presence of garnet and in the absence of feldspar. Dispersed concordia U-Pb ages, ranging from 205.1 ± 3.3 to 255.3 ± 6.1 Ma, defined a weighted mean $^{206}Pb/^{238}U$ age of 223 ± 8 Ma (mean square of weighted deviation, MSWD = 38), which is significantly younger than the Lu-Hf garnet-whole rock age of 242.2 ± 2.6 Ma. The U-Pb age probability distribution indicates two age populations at ca. 241 and ca. 216 Ma. The zircon rims, with younger ages, are distinguished from those with older ages by the occurrence of garnet and omphacite inclusions. Well-preserved prograde major- and trace-element zoning in garnet and the significant contribution of older garnet cores in bulk isotopic digestion suggest that the Lu-Hf age mostly reflects an early phase of garnet growth likely at amphibolite facies conditions. The new Lu-Hf age combined with the U-Pb ages of the zircon inclusions in garnet suggest that garnet growth was sustained over a time interval of ~25 m.y.

Keywords: Garnet, Lu-Hf, U-Pb, zircon