Zircon geochemistry records the action of metamorphic fluid on the formation of UHP jadeite quartzite

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A combined study of mineral inclusions, U-Pb ages, trace elements and Hf-O isotopes was carried out for zircons from a coesite-bearing jadeite quartzite in the Dabie orogen. The results provide insights into the action of ultrahigh-pressure (UHP) metamorphic fluids during continental deep subduction to a mantle depth and thus constraints on the origin of the jadeite quartzite in the continental subduction zone. The zircons show core-rim structures in CL images. The overgrown rims contain rare mineral inclusions, and exhibit concordant U-Pb ages of 225 to 246 Ma and flat HREE patterns with negligible Eu anomalies. In contrast, the relict cores contain UHP metamorphic mineral inclusions such as coesite, jadeite and rutile, and show discordant U-Pb ages (983 to 2045 Ma) and steep REE patterns with negative Eu anomalies. The U-Pb isotope data for the cores and rims define an apparent discordia line with upper and lower intercept ages of 2000±43 Ma and 234±18 Ma, respectively. We interpret the rims with Triassic ages as the new growth of metamorphic origin and the cores with Paleoproterozoic ages as the protolith relics of magmatic origin. The relict magmatic zircons underwent solid-state and metasomatic recrytallization. There are relatively consistent $\delta^{18}O$ values on all of the zircon domains, indicating not only that the metamorphic fluids are of internal origin from the deeply subducted continental crust but also that the O isotope composition of protolith zircons was reequilibrated with the metamorphic fluids of Triassic age. The metasomatic recrystallization of protolith zircons is indicated by the occurrence of UHP inclusion minerals in sealed microcracks. In this regard, the fluid metasomatism firstly took place along fractures of the relict zircons during prograde subduction of the continental crust and then experienced the metamorphic recrystallization to cause sealing of the fractures under the UHP conditions. The metamorphic fluids are enriched in Si, Ti, Na and Al and would be acquired through metasomatic reaction with metagreywackes overlying the granitic orthogneiss. Therefore, the jadeite quartzite would be precipitated from the UHP metamorphic fluids that were derived from dehydration of the underlying basement orthogneiss but reacted with the metagreywackes during the continental subduction-zone metamorphism.