



Metamorphic evolution of the garnet amphibolite from Longyou, SE China

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The Longyou area, located at the northeast of the Early Paleozoic orogenic belt of Cathaysia block, is composed of Neoproterozoic metamorphic rocks. The garnet amphibolite occurs as an isolated block, which consists of garnet, amphibole, plagioclase and minor minerals like quartz, ilmenite, clinopyroxene and epidote. There is a debate on the evolution of Longyou garnet amphibolite that whether the garnet amphibolite was retrograded from Early Paleozoic collision-related eclogite or formed by the regional metamorphism which is irrelevant to subduction. The major element concentrations of garnet amphibolite indicate that the sample has basaltic composition with slightly high TiO_2 content. The garnet amphibolite is depleted in large-ion lithophile element (LILE) and the chondrite-normalized rare earth element (REE) compositions display a LREE-enriched distribution pattern ($\text{La}_N/\text{Yb}_N=2.16-2.47$) with slightly negative Eu anomaly ($\delta\text{Eu}=0.89-0.90$) which is similar to the enriched mid-oceanic ridge basalt (E-MORB). In addition, the zircon Hf isotope analysis yields the calculated $\varepsilon\text{Hf}(t)$ from -1.5 to +3.1, suggesting a depleted mantle origin for the Longyou garnet amphibolite. The zircon U-Pb dating of the garnet amphibolite shows the metamorphism occurred at ca. 420-440 Ma and the protolith was formed in Neoproterozoic. Pseudosection modeling suggests a clockwise P-T path that the garnet amphibolite was metamorphosed under peak P-T conditions of 0.9-1.2 GPa and 800-850 °C, and the peak mineral assemblage is garnet+hornblende+plagioclase+ilmenite+quartz+ diopside+melt. The occurrence of the relic epidote indicates a pre-peak epidote-amphibolite facies metamorphism. The garnet grains exhibit typically retrograde growth zoning, showing increasing grossular and spessartine as well as decreasing pyrope content from the core to rim. The studies of petrography, geochemistry, geochronology and P-T pseudosection indicate that the Longyou garnet amphibolite was not retrograded from the UHP/HP eclogite, but experienced a simple loop from pre-peak epidote-amphibolite facies to peak high-pressure amphibolite facies and retrograde low-pressure amphibolite facies conditions.