The petrological and geochemistry study of epidote-group minerals in HP-UHP rocks from southwestern Tianshan, China

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The ultrahigh-pressure (UHP) metamorphic belt of Chinese southwestern Tianshan is the largest currently known UHP metamorphic terrane with oceanic crust that experienced deep subduction. It provides an important natural laboratory for understanding the subduction and exhumation processes of oceanic crust. Epidote-group minerals in HP-UHP eclogites, blueschists and epidote-bearing HP veins are studied. Various types of allanites and epidotes/ zoisites have been distinguished. Allanites (Aln) with core-rim structure are found in both eclogites and blueschists, with altered allanite in the core and neonatal allanite in the rim. This is the first time to document the altered allanite in the metamorphic rocks. There are five types of epidotes/zoisites based on their occurences: ①epidote, with paganite and/or quartz formed lawsonite pseudomorph, as inclusions in garnet (Ep-In); ② coarse-grained epidote porphyroblasts (Ep-P), sometimes relic allanite visible inside; ③fine-grained epidote in the matrix (Ep-M); ④coarse-grained epidote crystals in HP veins (Ep-V) and ⑤the latest stage epidote probably formed at epidote-amphibolite-facies (Ep-L).

The earliest allanite has the highest trace elment concentrations, enriched in L-MREEs and depleted in HREEs. In contrast, the latest Ep-L has the lowest trace elment concentrations, showing a LREEs depleted and HREE enriched pattern. The other epidotes/zoisites (Ep-In, Ep-M, Ep-P and Ep-V) are all enriched in L-MREEs and depleted in HREE, having the moderate but various trace elment contents. Aln, Ep-P and Ep-M have no Eu anomalies. Ep-In has negative Eu anomalies. In contrast, Ep-V and Ep-L have positive Eu anomalies. Ep-P and Ep-V also show complicated compositional zonations. Besides, their X_{Fe}, Th, U, Pb and Sr also display different. These characteristics may indicate the various types of epidote-group minerals are derived from different fluid sources. The Eu anomalies may reflect the changes of oxygen fugacity during subduction and exhumation processes of the oceanic crust.