Dehydration and anatexis of UHP metagranite during continental collision

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A combined study of zirconology and petrology was carried out for UHP metagranite from the Sulu orogen. The results reveal differential behaviors of dehydration and anatexis between samples from the same UHP slice. One mantle domain in sample-I zircon records eclogite-facies dehydration metamorphism at 236±5Ma during subduction, exhibiting low trace element contents, steep REE patterns without Eu anomalies, low temperatures of 651-750°C, and inclusions of quartz, apatite and jadite. The other mantle domain in sample-I zircon records high-T anatexis at 223±3Ma during exhumation, showing high trace element contents, steeper REE patterns with marked negative Eu anomalies, high temperatures of 698-879°C, and multiphase solid inclusions of albite+muscovite+apatite. On the other hand, one mantle domains in sample-II zircon records limited fluid-fluxed anatexis at 237±3Ma during subduction, showing high trace element contents, steep REE patterns with marked negative Eu anomalies, high temperatures of 601-717°C, and multiphase inclusions of albite+muscovite+apatite+ hydrohalite. The other mantle domain in sample-II zircon records low-T dehydration throughout the continental collision, exhibiting low trace element contents, steep REE patterns with weak Eu anomalies, low temperatures of 524-669°C, and anhydrite+gas inclusions.

Garnet, phengite and allanite/epidote in these two samples also exhibit different variations in texture, and major and trace element compositions, in accordance with the zircon records. The two samples have similar whole-rock major and trace element compositions, suggesting that the differential behaviors of dehydration and anatexis between them are caused by the difference in geothermal gradients during subduction and exhumation. Sample-I would locate in the interior of a crustal slice and experienced mid-T HP to UHP eclogite-facies dehydration metamorphism during subduction and then high-T dehydration melting during exhumation. In contrast, sample-II would lie at the top of the slice that is prone to fluid focus and thus experienced protracted low-T dehydration metamorphism and limited fluid-fluxed anatexis when the subducted slice meets the wet solidus of granitic rocks, and finally decompression exhumation. Therefore, the subducting continental crust underwent variable extents of dehydration and anatexis in response to the change in subduction-zone P-T conditions.