

## **Muti-stage metamorphic evolution of the North Qinling belt: constraints from petrology and zircon U-Pb study on Zhaigen and Songshugou retrograde eclogites**

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The North Qinling belt is an important HP-UHP metamorphic orogenic belt in China, which has been intensively studied. However, detailed metamorphic evolution which combined geochronological analysis to closely integrate with petrological studies should be further unravelled. A integrated study of the petrology, phase equilibria modeling and geochronology of the Zhaigen and Songshugou areas retrograde eclogites bring fresh informations to potentially understand tectonic implications of the North Qinling HP-UHP metamorphism in the early Palaeozoic.

Detailed petrographic investigation and mineral elements analyses discovered relic omphacite in garnet inclusions, and garnet grains preserved prograde metamorphic zonation both in major and trace elements. These retrograde eclogites experienced at least a four stages clockwise metamorphism evolution from pre-peak eclogite facies to eclogite facies, then back to granulite facies and the later amphibolite facies. In the retrograde eclogites, most zircon grains occur as homogeneous crystals, while some are present as overgrowth rims around inherited cores. The inherited cores have oscillatory zoning and yield U-Pb ages of *c.* 800 Ma, representing their protolith ages. The metamorphic zircons yield ages of *c.* 497-495 Ma and *c.* 470-450 Ma, representing eclogite-facies metamorphic age and retrograde metamorphic age, representively. These are consistent with the metamorphic and protolith ages of Guanpo UHP eclogite which lies at the north margin of the Qinling complex.

Zhaigen and Songshugou retrograde eclogites together with exsiting HP-UHP rocks in the North Qinling belt were formed within a single tectonic event involving continental subduction/deep subduction and exhumation.