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Dolomite dissociation indicates ultra-deep (>150 km) subduction of a garnet-bearing dunite block (the Sulu UHP terrane)

Bin Su[1,3], Yi Chen[1,2,*], Shun Guo[1,2], and Jing-Bo Liu[1]

[1]State Key Laboratory of Lithospheric Evolution, Institute of Geology and Geophysics, Chinese Academy of Sciences, P.O. Box 9825, Beijing 100029, China
[2]CAS Center for Excellence in Tibetan Plateau Earth Sciences, Beijing 100101, China
[3]University of Chinese Academy of Sciences, Beijing 100049, China

Abstract

The dissociation of dolomite into magnesite and aragonite has been regarded as a useful indicator for ultrahigh-pressure (UHP) metamorphism. In this study we investigate an unusual texture involving magnesite and calcite intergrowths with dolomite relicts in a garnet-bearing dunite block from the Sulu UHP terrane, eastern China. The carbonate intergrowths typically occur as interstitial grains with low dihedral angles against surrounding olivines and have a dolomitic precursor composition. Our observations indicate that the carbonate intergrowths were initially inherited from the well-documented magnesite and aragonite assemblage after dolomite dissociation. The initial dolomite grains were likely to crystallize during the dolomitic melt metasomatism within the shallow lithospheric mantle. A series of experimental studies have well determined the equilibrium boundary of dolomite = magnesite + aragonite greater than 5 GPa along a wide temperature range, which provides direct evidence that the dunite block was subducted to depths greater than 150 km during the Triassic continental subduction. The preservation of magnesite and aragonite (now calcite) intergrowths without dolomite synthesis reaction during exhumation is probably due to the lack of fluid and rapid decompression from the peak stage to the calcite stability field. In this study, we suggest that dunite blocks from high-pressure and UHP terranes could have subducted to UHP conditions similar to garnet lherzolite and pyroxenite and were then entrained into slab slices rapidly en route to the surface.

Keywords: Dunite, dolomite dissociation, ultra-deep subduction, Sulu belt