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FLUID ACTIVITY DURING EXHUMATION OF DEEP-SUBDUCTED CONTINENTAL CRUST: CASE STUDIES FROM THE DABIE-SULU OROGENIC BELT

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A great deal of studies have been devoted in past two decades to the composition and flow of fluid in HP and UHP metamorphic rocks that formed during subduction of oceanic crust. It has been recognized that a great deal of fluid was released during subduction of oceanic crust, resulting in arc magmatism, quartz veining and metamorphic mineralization of syn-subduction. However, knowledge concerning the origin of retrograde fluid is still incomplete, and sometimes misleading because it was simply ascribed to external origin by ignoring exsolution of internal fluids. With the advance in the study of stable isotopes, fluid inclusions and petrological phase relationships in HP to UHP metamorphic rocks that formed during the deep subduction of continental crust, it becomes clear that the compositional differences in continental and oceanic crusts result in differences in the mobility and amount of fluid within metamorphic products in the processes of subduction and exhumation.

A large number of studies involving stable isotopes, fluid inclusions and petrological phase relationships have been accomplished in past a few years with respect to the mobility and amount of metamorphic fluid in Triassic UHP metamorphic rocks from the Dabie-Sulu orogenic belt in east-central China. The results demonstrate that the fluid activity during the exhumation of deeply subducted continental crust has the following effects: (1) amphibolite-facies retrogression due to pervasive fluid flow; (2) formation of HP quartz veins within eclogites due to channelized fluid flow; (3) partial melting of overlying crustal rocks due to focused fluid flow, producing syn-exhumation magmatism within the UHP slabs of orogenic belt. In particular, the aqueous fluid released by decompression exsolution of hydroxyl from UHP minerals is characterized by low salinity and is capable of resulting in pervasive and channel flow.

Although the process of continental subduction is characterized by the relative lack of fluid with a limited mobility, heterogeneity in protolith composition and water concentration is found to result in the local activity of metamorphic fluid. During exhumation of deeply subducted continental crust, particularly, significant amounts of aqueous fluid became available from decomposition of such hydrous minerals as lawsonite, zoisite and phengite, decrepitation of primary fluid inclusions, and exsolution of structural hydroxyls from nominally anhydrous minerals. This kind of metamorphic fluid has recently attracted widespread interests and thus been one of the most important targets in deciphering the geological processes concerning metamorphism, magmatism and mineralization in collisional orogens.