Metamorphic zircon and its inclusion minerals from coesite-bearing eclogites of the Dabie Mountains (East-central China)

X. WANG AND X.J. YAO

Department of Earth Sciences and State Key Laboratory for Mineral Deposit Research, Nanjing University, Nanjing 210093, China

U-Pb dating of the metamorphic zircon from the coesite-bearing eclogites from the Dabie Mountains (East-central China) shows a spectrum of ages from 202 to 294 Ma (Ames et al., 1996; Rowley et al., 1997; Ayers et al., 2002). Whether the metamorphic zircon should be regarded as a UHP phase will be important for the geological significance of the U-Pb ages.

Morphological studies show the metamorphic zircon from three samples (BXL-2, BXL-3 and HCC-1) typically is small, multi-faceted, near-spherical grains with homogeneous internal structure. By the electron microprobe analysis, it is characterized by extremely high contents of HfO_2 (1.78 to 2.41 wt %) and very low contents of UO_2+ThO_2+Y_2O_3 (below 0.15 wt %). The homogeneous structure and the constant composition suggest that the metamorphic zircon was formed nearly in equilibrium with the surrounding medium. Therefore its high Hf contents may be explained by an increasing Hf partition coefficient if Hf of the bulk rock has not been enriched, which may be attributed to the UHP conditions.

Compared with the rock-forming garnet, the garnet included within such metamorphic zircon is characterized by: 1) the constant contents of CaO, MgO and FeO, indicating that it should be product crystallized at equilibrium; and 2) the higher component of grossular (up to 41.25%), indicating that it was formed under higher temperature condition. Similarly, the omphacite included within the metamorphic zircon is relatively enriched in the jadite component, which may reach 72% in HCC-1 sample, suggesting that it was formed under high pressure condition. So, these garnet-omphacite mineral pairs may be used to calculate the temperature of the peak metamorphism. Using the method of Ellis and Green (1979) with the minimum pressure of 2.8 GPa, the metamorphic temperatures are 731, 734 and 900℃ for BXL-2, BXL-3 and HCC-1, respectively. The similar temperatures for BXL-2 and BXL-3 should be attributed to the close location of sampling, but they are higher than that reported by Zhang et al. (1995). The temperature for HCC-1 sample may be regarded as the highest value of those reported in literature for the coesite-bearing eclogites from the Dabie Mountains. Consequently, the study on the inclusion minerals within the metamorphic zircon extremely enriched in Hf should be a potential method for reflecting the peak UHP metamorphic conditions.

Accessory minerals, trace elements, fluids and subduction

SORENA S. SORENSEN

Dept. Min. Sci., Smithsonian Inst., PO Box 37012, National Museum of Natural History, Washington DC, 20013-7012. (sorena@volcano.si.edu)

Accessory minerals in the variably altered, basaltic to ultramafic slab and subducted sediment, carry REE, HFSE, P, B, Sr, U, and Th into the mantle. Therefore, the P-T-fluid stabilities of accessory minerals both mediate transfer of geochemical tracers to the mantle wedge and affect time constraints upon mass transit within subduction zones. High P/T metamorphism creates eclogites and related rocks from basalts and minerals in these rocks record P-T-fluid reactions during subduction. Many trace element studies in subduction complexes focus on these rock types.

The behaviors of accessory minerals in eclogitic rocks differ between collisional (Alpine- or UHP-type) and subduction (Franciscan- or Pacific-type) metamorphic terrains. (The former show evidence for $P \geq 20$ kb and significant dessication at eclogite-facies conditions, whereas the latter record P = 10 to 15 kb and a long history of fluid-rock interactions, including at eclogite facies.) This study integrates information about the assemblages and compositions of accessory minerals in eclogites and related rocks from these terrains with data for high P/T fluid compositions. Mass balance studies of LT eclogites suggest trace element budgets of mafic rocks are controlled by accessory minerals that are stable over a wide range of P/T conditions. Discoveries of new UHP minerals suggest that complex reactions at these conditions may repartition trace elements in eclogites, and a variety of bulk compositions.