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Different Fluid Histories During the Metamorphic Evolution of North and South Dabie Shan, China

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The Dabie-Sulu ultrahigh-pressure (UHP) metamorphic belt in East China is known to be the largest among recognized UHP terrains in the world. It represents deep parts of a collision zone between the North China and Yangtze cratons. Tectonically, the Dabie Shan could be subdivided into four metamorphic units: the North Huaiyuang metamorphic belt, the North Dabie Complex (NDC), the South Dabie UHP Terrain (SDT), and the Susong metamorphic belt (Liou et al., 1995). Recent geochronologic investigations revealed significantly different ages for the SDT and NDC; a narrow age range of 210-230 Ma has been determined for the SDT (e. g. Ames et al., 1993; Li et al., 1993), whereas zircon U-Pb ages for the orthogneiss, which is the major component of the metamorphic rocks in the NDC, range from 138 to 125 Ma (Xue et al., 1997; Hacker et al., 1998). The main rocks of the NDC, characterized by ISr of 0.709-0.710 and $\varepsilon_{Nd}(T)$ of -15 to -20, were derived by partial melting of the lower-intermediate crust; by contrast, most gneisses from the SDT have higher $\varepsilon_{Nd}(T)$ values of -2 to -10 (Jahn et al., 1999) . Coesite-bearing eclogites are abundant in the SDT, whereas eclogitic rocks have not been undisputably identified in the NDC so far, although UHP metamorphism has been inferred based on some relic minerals (Tsai and Liou, 2000). The present study deals with the different metamorphic fluid evolution of the NDC and the SDT terrains. Major element microprobe analysis, oxygen isotope laser-probe measurements, hydrogen isotope data and detailed fluid inclusion studies on various minerals in key samples from both areas lead to the following conclusions: i) Metamorphic rocks in the Dabie Shan area display a large range of $\delta^{18}O$ values, which probably resulted from variations of their protoliths and from heterogeneous fluid-rock interactions. The protoliths of eclogites from the SDT have interacted with meteoric water on a regional scale prior to subduction, whereas the oxygen isotope compositions of the metamorphic rocks from the NDC show no obvious indications of water-rock interaction before metamorphism. ii) Fluid systems of the UHP metamorphic rocks in the SDT evolved from highly concentrated Ca-rich brines (prograde metamorphism) towards NaCl-dominated solutions (peak metamorphism) and low salinity aqueous fluids during retrograde metamorphism, while those of the metamorphic rocks in the NDC were dominated by CO_2-rich fluids, corresponding to granulite-facies metamorphism. iii) Oxygen isotope and fluid inclusion data imply that there were various retrograde fluid-rock interactions within metamorphic rocks from both SDT and NDC, which was, however, limited and heterogeneous in the SDT, and perhaps regional in the NDC. The different fluid evolution and P-T paths of the SDT and NDC areas, as represented by Bixiling and Raobazhai eclogites respectively, are shown in Figure 1.

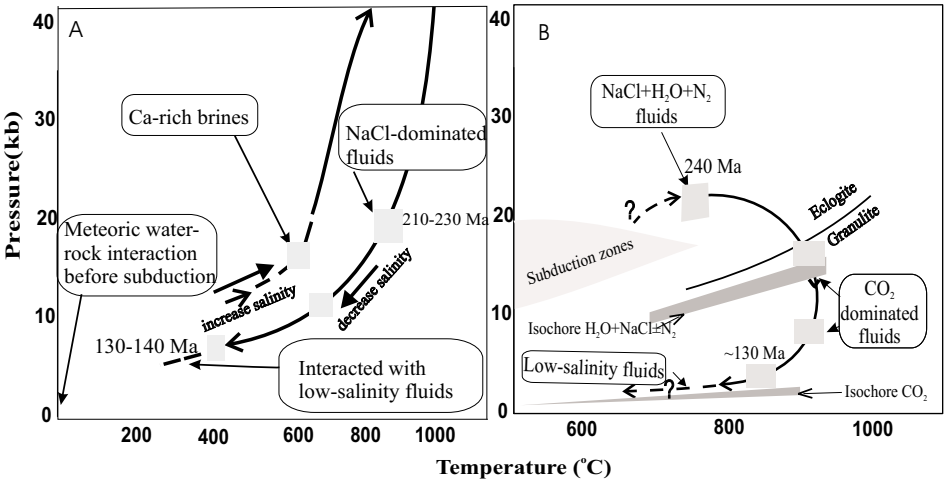

Figure 1: P-T-t-fluid paths of the Bixiling eclogite in the SDT (A) and the Raobazhai eclogite in the NDC (B) represented by Bixiling and Raobazhai eclogites respectively.