Petrology of dolomitic marble and eclogites from the Dabie UHP terrane, eastern China

Takuya Sawada[1], Yoshihide Ogasawara[2], Shigenori Maruyama[3]

[1] Earth Science, Waseda Univ, [2] Earth Sci., Waseda Univ., [3] Earth and Planetary Sci., Tokyo Institute of Technology

The peak metamorphic temperature of the UHP rocks from the Wumiao~Shima area was estimated by grt-omp and grt-phe geothermobarometers in order to clarify the thermal structure in the north to south direction. Presuming P=3GPa, peak metamorphic temperature is irregular and ranging from as 620 to 700. According to this result, XCO2 conditions of this dolomitic marble were constrained: XCO2 < 0.005 at 620C and XCO2 < 0.01 at 700. The present study also described forsterite coexisting with Mg-calcite in the dolomitic marble. The stability of forsterite requires much lower XCO2 condition. Therefore it seems to be difficult in UHP metamorphism (e.g. H2O source. Forsterite-bearing assemblages may be explained for retrograde formation of forsterite during decompression process.

The Dabie-Sulu ultrahigh-pressure (UHP) terrane that is the largest in the world is located in the Triassic continental collision zone between Sino-Korean and Yangtze cratons. Many previous studies reported that Sino-Korean craton had subducted underneath Yangtze craton from south to north. Recently, Kaneko et al. (2000), however, reported the opposite interpretation that Sino-Korean craton had subducted to Yangtze craton from north to south. In order to contribute to solve this big discussion, the authors have conducted the petrological study on the metamorphic rocks in detail. The purpose of this paper is to present the petrography of the UHP rocks from the Wumiao-Shima area in northern to central Dabieshan, and to discuss the metamorphic conditions in this area. This study focused on 1) mineral assemblages of eclogites, 2) estimation of peak T conditions from the Wumiao~Shima area on the basis of garnet-ompchacite and garnet-phengite geothermobarometers, 3) estimation of P-T- XCO2 conditions of diopside- and forsterite-bearing dolomitic marbles.

Coesite-bearing eclogites occurs in the whole Wumiao-Shima area. Coesite and coesite pseudomorphs are abundant particularly near Wumiao (e.g., 15 to 20 grains in one thin section). Zoisite eclogites (+/- coesite) occurs in this area and their amount gradually increases from Wumiao to Shima. Zoisite eclogites contain maximally 25vol% of zoisite. Some eclogites were strongly retrograded to amphibolite phase's assemblages. The distribution of the retrograde metamorphism of eclogites in this area is heterogeneous

The peak metamorphic temperature of the Wumiao~Shima area was estimated by garnet-omphacite and garnet-phengite geothermobarometers in order to clarify the thermal structure in the north to south direction. Presuming P = 3GPa, peak metamorphic temperature is ranging from as 620 to 700. No temperature gradient was detected from Wumiao to Shima.

Dolomitic marble occurs at location DJ17 (about 4km south of Wumiao). Mg-calcite in this marble contains slight amount of MgCO3 (from 0 to max. 3.6 mol%). The MgCO3 content in calcite is heterogeneous in a single grain. The occurrence of this Mg-calcite indicates aragonite-dolomite coexistence under UHP conditions. Mg-calcite in UHP marble formed from aragonite with small-grained dolomite inclusions during retrograde stage (Ogasawara et al., 1998). The mineral assemblage of this dolomitic marble at peak metamorphic condition was aragonite + dolomite + diopside. Assuming that P = 3GPa, XCO2 conditions of this dolomitic marble were constrained by the decarbonation reaction dolomite + coesite = diopside + CO2 as in the stability field of right-hand side of this reaction: XCO2 < 0.005 at 620 and XCO2 < 0.01 at 700.

Coesite inclusion in dolomite has been reported at the location of about 25km south of Wumiao (Schertl & Okay, 1994; Zhang & Liou, 1996). Zhang & Liou (1996) considered that the metamorphic conditions were located on the equilibrium reaction curve: dolomite + coesite = diopside + CO2 at T ~760, P >2,8 GPa, and 0.01 < XCO2 < 0.1. Their XCO2 values are slightly higher than our value. This indicates the difference and heterogeneity of fluid composition during UHP metamorphism in the Wumiao-Shima area.

The present study also described forsterite coexisting with Mg-calcite in the dolomitic marble. The stability of forsterite requires much lower XCO2 condition than dolomite-diopside assemblage. XCO2 condition in dolomite-diopside-aragonite marble was extremely low as 0.005 to 0.01; therefore, much lower XCO2 condition in dolomitic marble seems to be difficult in UHP metamorphism (e.g.H2O source). One of the possible explanations for forsterite-bearing assemblages may be retrograde formation of forsterite during decompression process.