Phase equilibria of MT–UHP eclogite: a case study of coesite eclogite at Yangkou, Sulu belt, China

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In this study, we present an example of phase equilibrium modeling of MT–UHP eclogites that includes consideration of the influence of ferric iron (*O*) and H_2O on the phase equilibria. As a case study, we take the intergranular coesite-bearing eclogites at Yangkou in the Sulu belt. Based on phase equilibrium modeling of four eclogites, we monitor changes in phase relations during deep subduction and exhumation, and investigate fluid behavior during decompression. To determine the appropriate *O* and H_2O contents to use in calculating P–T pseudosections for these eclogites, we use an iterative process in which calculated temperature/pressure (*T/P*)–O/H_2O phase diagrams are combined with constraints from petrological observations. *P–T* pseudosections were calculated for each of the four eclogites to constrain the *P–T* conditions. The highest *P–T* conditions retrieved were $P >$ 5.5 GPa at $T >$ 850 °C, although variation in mineral compositions suggests the maximum *P–T* conditions could have been higher. A *P–T* path was reconstructed based on microstructural evidence, mineral compositions that constrain *P–T* conditions within phase assemblage fields, average *P* calculations and mineral thermobarometry. During exhumation, the retrograde *P–T* path passed through metamorphic conditions of P = 4.0–3.4 GPa at T = 850–800 °C and P = 2.4–1.7 GPa at T = 800–750 °C, before reaching crustal levels at P = 1.3–0.9 GPa and at T = 730–710 °C. The prograde evolution is suggested to have followed a high *dT/dP* path during the early stage of subduction, followed by a low *dT/dP* segment to the metamorphic peak. During exhumation, the eclogites at Yangkou became domainal, made up of host rock with low $a_{(H2O)}$ in which garnet and omphacite have partially re-equilibrated and intergranular coesite has been preserved, cut by veins and veinlets where $a_{(H2O)}$ was higher and new mineral assemblages have developed.