ECLOGITES FROM THE CCSD - DIFFERENT P-T PATHS AS INDICATION FOR A SUBDUCTION CHANNEL ENVIRONMENT

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Four phengite-bearing eclogites, taken from different depths (464, 579, 1899, 1991 metres, samples B218, B301, B1008 and B1039, respectively) of the CCSD borehole (XU, 2004) in the Sulu ultrahigh pressure (UHP) terrane, eastern China, were carefully studied with the polarising microscope and the electron microprobe. The compositional zonation of garnet and omphacite is moderate, whereas phengite compositions generally vary significantly in a single sample from core to rim by decrease of Si contents and increase of the Na / (Na+K) and Fe / (Fe+Mg) ratios. Various geothermobarometric methods were applied to constrain the P-T conditions of these eclogites on the basis of the compositional variability of the above minerals. The derived P-T path for sample B218 shows a pressure decrease starting at ~3.0 GPa (close to 600 °C) with slightly falling temperatures to reach finally conditions of ≤ 1.8 GPa and 500 °C accompanied by formation of corona textures around omphacite and garnet. Kyanite-bearing eclogite B310 did not allow to construct a P-T path but the temperatures of an early eclogite stage are ~100 °C higher than those of the other three samples. Eclogites B1008 and B1039 show similar but complicated P-T paths which start at about 650 °C and 3.6 - 3.9 GPa (stage I), followed by a pressure decrease to about 3.0 GPa and a moderate to significant temperature rise (stages II and III) by up to 100 °C. Subsequently, the temperatures decreased to about 500 °C (stage IV) at pressures close to 2.0 GPa or less. During the final metamorphic stage recorded in the CCSD eclogites (stage IV and younger) fluids partially rich in potassium, probably of hydrous nature, penetrated the rocks. However, these fluids caused minor changes only. Among the newly formed minerals are andradite and magnetite pointing to relatively high fO_2 values of the fluid phase.

We think that the above findings (different P-T paths, heating and cooling events at moderately decreasing pressures, relatively small volumes of interacting fluids) can be best explained by mass flows in a subduction channel environment. However, this environment implies that the assembly of UHP rocks of the CCSD site, eclogites, quartzofeldspathic rocks, and peridotites, cannot represent a crustal section that was already coherent at UHP conditions as it is the common believe currently. The coherency was attained after significant exhumation of these UHP rocks possibly at a depth level close to 60 km corresponding to 1.8 GPa of stage 4.

Reference

XU, Z.-Q. (2004): Acta Petrologica Sinica, 20, 1-8.