

Multiphase solid inclusions in UHP eclogite from the Dabie orogen: Constraints on the nature of metamorphic fluid/melt during continental subduction-zone metamorphism

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There is growing evidence that multiphase solid (MS) inclusions preserved in UHP metamorphic minerals, such as garnet and omphacite, can derive from the trapped melts. This provides insights into the nature and composition of melt phases during subduction-zone metamorphism. Some MS inclusions may contain evidence for the existence of supercritical fluid in addition to hydrous silicate melts, enabling to recognize the mobility of trace elements in metamorphic fluid/melt.

Several types of MS inclusions were identified in garnet from UHP eclogite in association with UHP paragneiss at Shuanghe in the Dabie orogen, China. Chemical composition of the inclusions ranges from pure K-feldspar to pure quartz, with predominance of intermediate compositions composed of K-feldspar + quartz \pm silicate (albite, plagioclase, or epidote) \pm barite. Typical MS inclusions are usually surrounded with radial cracks in the garnet. LA-ICPMS *in situ* analyses of the MS inclusions and host garnet indicate strong enrichment of LILE, LREE and HFSE in the inclusions relative to the garnet, with significantly negative Ce anomalies in the inclusions. Barite shows significant heterogeneities in major element composition with total contents of only 50 to 70%, a negative correlation between BaO and SO₃ contents, and highly variable SiO₂ contents of 0.32 to 25.85% that are positively correlated with the BaO and SO₃ contents. These suggest the presence of microvoids and microcrystalline quartz in the barite and thus the occurrence of mixed silicate-sulfate melts in the UHP eclogite.

An integrated study of petrology, mineral chemistry and trace element geochemistry of the MS inclusions suggests that partial melting in the eclogite took place at the initial stage of exhumation but still in the coesite stability field. The partial melting was triggered by influx of aqueous fluid due to phengite decomposition. This results in the coexistence of hydrous silicate melts and aqueous fluids in the garnet under UHP conditions. Along with the consistent enrichment of LILE, REE and HFSE in the inclusions, the involved fluid is suggested to become supercritical at the peak UHP phase.

Bicarbonate competition in the desorption of arsenic species from sediments

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Release of arsenic from the sediments into groundwater may contribute to the elevation of arsenic content in groundwater, especially in the areas with abnormal high arsenic contents in the sediment, such as Bengal Delta (India), Inner Mongolia and Datong (northern China). This work studied the effect of bicarbonate on the desorption of four main arsenic species [As (III), As (V), DMA and MMA) in natural sediment samples (Faridpur surface soil from Bangladesh and sediment core samples DY 12 from Datong Basin) [1]. The desorption rate of four arsenic species was investigated while the bicarbonate concentration loading increased from 100 to 1, 500 mg/L in batch experiments. Bicarbonate concentration of 500 mg/L was selected in the column test based on field measurements of bicarbonate concentration in Datong Basin [2, 3]. The results indicate that even a low loading of bicarbonate of 100 mg/L can cause a relatively high release of total arsenic (about 10 μ g/L) from sediments. Difference in the desorption extent of four arsenic species is also observed in the study.

[1] Hu *et al.* (2010) *3rd International Congress on Arsenic in the Environment* (accepted). [2] Wang *et al.* (2009) *Applied Geochemistry* **24**, 641–649. [3] Sengupta, S. *et al.* (2004) *Environmental Geology* **45**, 1071–1081.