OXYGEN AND HYDROGEN ISOTOPE INHOMOGENEITIES, AN IN SITU STUDY ON ECLOGITES FROM DABIE SHAN, CHINA

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Dabie Shan eclogites are well known for their low oxygen ($\delta^{18}O$ = -11 ‰ wr) and hydrogen isotopic signatures (δD= -60 to -100 ‰ for mica and amphibole, e.g. RUMBLE & YUI 1998, ZHENG et al. 2003), the lowest ever observed in an UHP terrane. These low values are explained by the interaction with meteoric waters prior to the ultra high pressure event. The preservation of these early signatures suggests a fast subduction followed by a rapid uplift. The heterogeneity of the isotopic signatures at the outcrop scale gives evidence of later fluid events. In this study, O and H isotopic signatures have been investigated at the microscale to trace the behaviour of these fluids during subduction and exhumation in more detail. Thus O-isotopes on garnets and H- isotopes on micas and amphiboles were analysed by ion microprobe on samples from Bixilling and Shuanghe after reconstruction of their PT paths.
Bixilling garnets are unzoned in main elements, whereas Shuanghe ones may be unzoned or zoned, with zonations associated with their retrograde path. O isotopes show constant values within each sample for Bixilling garnets, with a $\delta^{18}O$ variation from 0 to 6 ‰ on the whole sample set. Values 1 2 ‰ higher in rim than in core are occasionally observed. For the Shuanghe samples suite, $\delta^{18}O$ ranges from –10 ‰ to +10 ‰ with variations up to 7 ‰ within a sample. Typical variations are observed 1) along veins with values decreasing of 2 - 3 ‰ away from the vein, 2) in single minerals with rims 3 to 6 ‰ higher than cores and 3) on mm and cm scale within samples without any clear association with a fluid pathway. The constant values for Bixilling support that the garnets preserved an initial mantle signature, without meteoric water interaction prior to subduction. In contrast, the Shuanghe garnets negative $\delta^{18}O$ values indicate an early hydrothermal meteoric waters overprint. During subduction, these primary values are preserved for both localities. Exhumation had only a minor effect on Bixilling garnets, whereas Shuanghe garnets show overprint from mantle or crustal waters.
For hydrogen isotope the lowest δD values are observed in the UHP white micas for both localities (δD from -230 to -120 ‰ for Bixilling and -190 to -150 ‰ for Shuanghe). Amphibole shows higher δD values (-110 to -50 for all samples except one Shuanghe sample -10 to -40 ‰). Therefore, for Bixilling, in contrast to oxygen isotopic data from garnet, hydrogen data in white mica shows an overprint from the meteoric water prior to subduction, which is preserved due to the low H diffusion in white mica (GRAHAM, 1981; ZHENG et al., 2003). The retrograde phases such as biotite and amphibole seem to present a "mix-signature" in between the initial negative values and later more positive retrograde fluids.

References

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