Geochemical Zr behaviour in the deep crust around metasomatic vein composed of Cl-rich Hbl and Grt

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Behaviour of zircon (Zrn), hosting most of the bulk rock Zr, is a matter of interest to discuss mass transfer, because Zr is often used as 'immobile element' in estimating relative mass addition/loss [e.g., 1]. In the Sør Rondane Mountains, East Antarctica, about 1 cm-thick garnet-hornblende (Grt-Hbl) vein discordantly cuts the gneissose structure of the wall rock. With distance from the vein center, Cl contents of Hbl and biotite (Bt), K content of Hbl, as well as the development of Na-richer rims of plagioclase decrease and become constant at a few cm away from the vein. These compositional changes possibly imply that the Grt-Hbl vein was formed by NaCl-KCl-bearing fluid or melt infiltration [2]. The *P-T* conditions for the vein formation is estimated using geothermobarometers to be ca. 700°C and 0.7 GPa.

With distance from the vein center, 1 cm-thick slices were prepared parallel to the Grt-Hbl vein, and bulk rock Zr concentration of each slice was determined by ICPMS. The bulk rock Zr concentrations stayed almost constant from the vein to the wall rock beyond the distance where Cl concentration of Hbl and Bt becomes constant. Every Zrn grain preserves the same zoning profile as recognized by cathodoluminescence images. Grain size of Zrn, and U-Pb ages and REE concentrations of Zrn rim are constant with distance from the vein. The rim age is consistent with the timing of peak metamorphism in this area within error [3]. Therefore, it is concluded that Zrn is not significantly dissolved or overgrown during the Grt-Hbl vein formation in this sample and that the timing of the vein formation is not recorded in Zrn. This suggests that Zr is an appropriate immobile element for analysing relative mass addition/loss around the vein. In addition, using elemental partitioning between fluid, melt, and mineral [4], we discuss whether NaCl-KCl-bearing fluid or melt infiltrated.

[1] Ayers & Watson (1991) [2] Higashino et al. (2015) [3] Adachi et al. (2013) [4] Keppler (1996)