I130-001 **Room: 301B** **Time: May 18 9:00-9:15**

Material transfer, volume change and stress generation during the kelyphitization of garnet -Part 2

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Kelyphite is an extremely fine-grained fibrous sympectic intergrowth of pyroxene and spinel (occasionally with amphibole), typically developed as a rim surrounding garnet. A thin zone of coarse orthopyroxene is typically developed between this fine-grained zone (i.e., kelyphite) and surrounding olivine.

Kelyphitization of garnet occurs by the reaction

Garnet + olivine = Cpx + Opx + Spinel (1)

This reaction can be subdivided into:

Garnet + ’alpha’ = Cpx + Opx + spinel + ’beta’ (2) and

Olivine + ’beta’ = Opx + ’alpha’ (3)

,where ’alpha’ and ’beta’ are the mobile chemical components, which may be identified only when the reference frame is specified. At the last year JGU Annual meeting Obata (2008) obtained ’alpha’ and ’beta’ on the basis of the volume-fixed reference frame. Here we suggest an alternative, oxygen-fixed reference frame to apply to reactions (2) and (3). This oxygen-fixed reference frame is considered to be more appropriate as a reference frame considering the results obtained by EBSD on kelyphite (Obata and Ozawa, this volume). We modeled the mass transfer in reactions (2) and (3) using the mineral composition from a kelyphite in a Norwegian garnet peridotite (Spengler et al, 2004). In an oxygen-fixed reference frame, reaction (2) is a volume-increase- and reaction (3) is a volume-decrease reactions and thus considerable stress may be generated as the reaction proceeds. We quantified this stress by applying and expanding the three-layer elastic-shell model of Lee and Tromp (1995). The result includes that a large tangential compressional stress is generated at the garnet-kelyphite interface and that it decreases monotonically outwards; while normal stress is low at the interface and increases monotonically outwards. In particular, when olivine that surrounds the kelyphite is assumed to be a ’fluid’ (i.e., assuming no strength for olivine), the normal stress at the garnet-kelyphite interface becomes tensile. In either cases a large tangential tensile stress is generated in the coarse-Opx zone surrounding the kelyphite. The effect of such non-hydrostatic stress must be considered for understanding the reaction mechanism. The calculated stress pattern supports the hypothesis that the ’law of normality’ empirically found for kelyphites is a manifestation of a non-hydrostatic stress generated in the kelyphitization reaction (Obata, 2006).