Stability pressure of the supersilicic garnet in the SiO_2 saturated system -- constraining the peak pressure of the UHP gneiss from the Songshugou area in the North Qinling

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Amount of experimental petrological studies in SiO_2 unsaturated ultra-mafic system indicated that, at the pressure of >5GPa, garnet became supersilicic because of the presence of the coupled substitutions $Si^{VI}+M^{VI}=Al^{VI}+Al^{VI}$and $Si^{VI}+Na^{VIII}=Al^{VI}+M^{VIII}$ (M = Mg, Fe, Ca) (Ringwood and Major, 1971; Gasparik, 1989; Ono and Yasuda., 1996), which laid a theoretical foundation for understanding the deep mantle inclusion, the formation mechanism of the pyroxene exsolution in garnet in UHP rocks and the stable pressure before the supersilicic garnet exsolved. However, although there are abundant HP-HT experimental data in the SiO_2 saturated system, the stability condition of the supersilicic garnet is still unclear. For better constraining the peak metamorphic condition of the supersilicic garnet and its geological implication, HT-HP experiment simulating the system of continental felsic rock at P=6-12GPa, T=1200-1400°C was carried out in this study.

Our experimental result indicates that the minimum stable pressure of the supersilicic garnet in the felsic system is ≥10GPa, which is consistant with that from Irifune *et al* (1994). Meanwhile, the experimental data from Ono. (1998), Dobrazhinetskya and Green. (2007) and Wu *et al* (2009) also show that the stable pressure of the supersilicic garnet is ≥9-10GPa in SiO_2 saturated system. These are different from that of ≥5GPa in the ultra-mafic system without independent SiO_2 phase.

Recently, abundant fine-grained exsolutions of Rt + Ap + Qtz needles are observed in the the garnet core in the felsic gneiss from the Songshugou area in the North Qinling terrane, which suggests that the precursor garnet before exsolution contain excess Si, Ti, and P. According to the new experimental data, the peak pressure of the rock is inferred to be ≥10GPa, indicating the depth of the continental subduction / exhumation is ≥300km.