The preliminary results of piston cylinder experiments to homogenize multiphase solid inclusions observed in high pressure granulites and garnet-bearing peridotite in the Bohemian Massif

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In the present-day Alpine Himalayas and the Paleozoic Variscan orogenic belt, ultrapotassic volcanism occurred in the late stages of orogeny. The source of potassium is expected to be subducted pelitic rocks that partially melted and eventually emitted potassium-rich melts to the hanging wall mantle (e.g., Grassi and Schmidt, 2011). This resulted to form phlogopite-bearing peridotite in the mantle wedge, which can generate ultrapotassic magma upon partial melting (durbachite in the Czech Republic and kamafugite in Italy). To quantitatively understand this process, it is first necessary to determine the chemical composition of the partial melts or supercritical fluids both in the subducting plate and in the mantle wedge.High-pressure to ultrahigh-pressure metamorphic rocks may contain melts and supercritical fluids generated in deep plate convergence zones - at depths of 50 to 200 km - that are trapped in high-pressure minerals such as garnet. Melts and supercritical fluids cooled and crystallized to form multiphase solid inclusions. Recently, several studies have focus on their chemical composition and its relationship with post-orogenic ultrapotassic magmatism (e.g. Borghini et al., 2019). To conduct experiments to homogenize the multiphase solid inclusions, a few mm of garnet was first separated from the garnet pyroxene rock and sealed, along with quartz, in a gold capsule. 10% gibbsite was added for hydrous experiment. The samples were kept at 3 GPa and 1000˚C for 24 hours in a piston-cylinder apparatus, then quenched, and observed using an electron microscope. It turned out that most garnet grains are decomposed under wet condition. On the other hand, under dry conditions, the multiphase solid inclusions successfully homogenized whose chemical composition is: SiO_2*=70-74 wt%, Al_2O_3≃12 wt%、MgO=0.3-2.0 wt%, CaO=1.1-1.8 wt%, K_2O=6.0-6.5 wt%. Since the analytical values are 80-87 wt%, the mass of fluid components in the melt is estimated to be 13-20 wt%. On the other hand, melt inclusions in chromite from garnet peridotites is poor in SiO_2 and rich in MgO and CaO, suggesting silica undersaturated melt. This is first preliminary report on homogenization experiments, and we plan to accumulate melt dataset that led to quantitative understanding of the material transfer from subducting plate to the mantle wedge.

Keywords: Continental collision, garnet peridotite, high pressure granulite, multiphase solid inclusion, piston cylinder