The physicochemical stability of crystalline zircon depends upon minor elements in solid-solution. If solubility limits in certain parageneses could be established, the widely applied U-Th-Pb geochronometer may be directly linked with the P/T-conditions of primary zircon growth or recrystallization. The xenotime substitution Zr$^+$Si$^-$ = (Y,HREE)$^+$P, accounting for the isostructural xenotime-type orthophosphate component in zircon, seems promising for this purpose. Knowledge of this substitution is incomplete although limited miscibility between zircon and xenotime was repeatedly suggested from coexisting natural phases. Published experimental studies succeeded in synthesizing zircon-xenotime solid-solutions by using a dry sintering technique and by the Li-Mo-flux-method [1]. However, no experimental determinations of solubility limits at the solvus between coexisting zircon and xenotime are currently available.

Using a piston cylinder apparatus, we synthesized accessory phases in fluid-saturated silicate melts (initially near albite-quartz compositions). Starting materials were prepared from admixtures of silicate glass and oxides. An explorational experimental series was done at temperatures between 800°C and 1300°C and pressures between 0.8 GPa and 2.3 GPa. Below 1000°C, results were disappointing due to sluggish reaction rates and very small crystal sizes. Higher temperature experiments, however, gave coexisting zircon and xenotime large enough for reliable electron microprobe analysis. Accordingly, the miscibility gap between zircon$_{ss}$ and xenotime$_{ss}$ closes with increasing temperature and pressure has the opposite effect. A comparison of our preliminary experimental data with natural zircon data from the literature suggests that xenotime solubility in xenotime-saturated zircon$_{ss}$ lacking significant amounts of additional elements is of the order of 10 mol.% at granulite facies conditions.