An X-ray diffraction study and a Raman spectroscopic analysis at elevated pressure conditions have been carried out on two cryptocrystalline silica minerals, chlordeydon and chrysoprase. The chlordeydon samples are of fibrous variety and the chrysoprase specimens are granular in microstructure. X-ray diffraction measurements indicate that the crystallinity index of the chlordeydon is inferior to that of the chrysoprase. The variation in crystallinity between these two samples is also consistent with the Raman spectroscopic analysis. At ambient conditions, a principal Raman peak of the chrysoprase has a wavenumber of 466.1cm⁻¹ instead of 464.3cm⁻¹ for a crystalline quartz specimen. With increasing pressure, this Raman peak shifts toward a higher wavenumber region, and its FWHM value increases. At 15 GPa, this 466-cm⁻¹ peak has moved to 565.0cm⁻¹. The peak has significantly broadened in peak width, indicating the deterioration of the crystallinity of the sample.

No obvious structural phase transformations were observed within the studied pressure range for both cryptocrystalline silica samples. The pressure effect on amorphization of cryptocrystalline SiO₂ is more profound for chlordeydon than for chrysoprase.

Members of the feldspar group of minerals are the most abundant constituents of igneous rocks and form a major component of the Earth's crust. A knowledge of their high-pressure and high-temperature behaviour is, therefore, crucially important for the understanding of crustal chemical and thermodynamic processes. Previous high pressure single-crystal x-ray diffraction studies of well-ordered K-rich microcline have identified discontinuities in the pressure dependence of the a and β unit-cell angles at approximately 3.8 GPa while, in contrast, the rate of change of γ was found to be continuous. The volume reduction accompanying this change in behaviour was found to be too small to be measurable and studies conducted above ~3.8 GPa did not reveal a change in symmetry. We have now repeated these earlier unit-cell measurements, but over a pressure range extended from ~4.8 GPa to ~7.1 GPa and we have also determined the underlying pressure-induced changes in the crystal structure for the first time.

Our preliminary results confirm the findings of the previous study and indicate that the structural changes with pressure are remarkably strong. The potassium atom, for example, initially undergoes a large continuous shift which is principally directed along the a-axis and at pressures above 3.8 GPa there is an abrupt change with a strong additional c-axis component. Accompanying the potassium atom displacement some of the key Si(Al)-O-Si(Al) linking bonds exhibit very large changes of up to 18° at 7.1 GPa. Indeed, the sudden change in the pressure dependence of some of the linking bond angles at 3.8 GPa may partly account for the discontinuity in the rate of change of the unit-cell angle β at the same pressure.