# Mineralogy of serpentines at the sub-micron scale

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Serpentinisation is a widespread process. Oxidation of $Fe^{2+}$ coupled to reduction of water produces $H_2$, enabling organosynthesis. The Mg-rich terrestrial serpentines can also incorporate $Fe^{3+}$, thus contributing to $H_2$ production especially at low-temperature, as well as Al. Serpentinisation is hypothesized on Mars, and would have taken place in a Fe-richer environment than terrestrial ones. In small bodies of the solar system, sampled by carbonaceous chondrites, serpentines with variable compositions in the $Fe^{2+}$-$Fe^{3+}$-Mg-Al-Si-O-H system are observed.

Better understanding the conditions of formation of serpentine on Earth, in meteorites or through spatial missions requires the thermodynamic modelling of serpentines solid solutions. However, the structural evolution of serpentines in the compositional space explored in various environments is poorly known, due to the frequent small size of the crystallites.

We present the results of a synchrotron based nano-beam X-ray diffraction computed tomography study aimed at extracting single crystal X-ray diffraction data from sub-micron minerals in meteorite samples. The feasibility of the technique is illustrated by the structure refinement of forsterite grains. Structural data of serpentine minerals, which chemistry had been previously studied at the nanometer scale, and with sizes of hundreds of nm are then extracted. Comparison with literature data provides encouraging results on the ability of this approach to extend the known structure-composition field of serpentines.