Nucleation and growth of silica nanoparticles: An *in-situ* SAXS and DLS study

D.J. TOBLER[1,2] L.G. BENNING[1,2] AND S. SHAW[1]

[1] School of Earth and Environment, University of Leeds;
[2] Earth and Biosphere Institute, University of Leeds;
tobler@earth.leeds.ac.uk, liane@earth.leeds.ac.uk;
sam@earth.leeds.ac.uk

The precipitation of silica in active geothermal systems is a well know process leading to the silicification of microorganisms and to the formation of silica sinters. Several studies have considered the interaction processes between microorganisms and the inorganically nucleating silica particles, or have studied the rates of amorphous silica nucleation in hot springs. However, so far a molecular level mechanistic understanding of the formation of primary silica particles under such conditions and an agreement on the rates of silica polymerization is still lacking.

Here we present preliminary data for the *in-situ* and in real-time quantification of the first steps in the silica polymerisation process under conditions mimicking processes in modern hot springs. We used synchrotron-based *in-situ* and time-resolved Small Angle X-ray Scattering (SAXS), conventional Dynamic Light Scattering (DLS) combined with cryo-HR-TEM to follow the nucleation and growth of silica nanoparticles under varying silica concentration and in the absence/presence of organic compounds. We have quantified the critical nucleus size (4nm), as well as the particle growth rates, and changes in polydispersity. Our data shows that the polymerization process follows a 1st order reaction kinetic process that is driven by a surface incorporation mechanism (see figure).