In-situ measurements of quartz solubility using the hydrothermal diamond anvil cell

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The solubility of quartz has been determined in a hydrothermal diamond anvil cell within the temperature and pressure ranges of 22°C to 650°C and 1 bar to 8 kbars, respectively. A novel approach has been used to measure the amount of dissolved silica. The quartz was abraded into tiny spheres which have a diameter of ~ 50um. The spheres were then placed in pure water inside the diamond anvil cell and heated externally. Because the transparency of the diamonds allows direct observation of the sample chamber during the experiment, we were able to estimate the amount of quartz dissolved in the water at various stages of the dissolution process by measuring the decrease in the sphere's diameter over time.

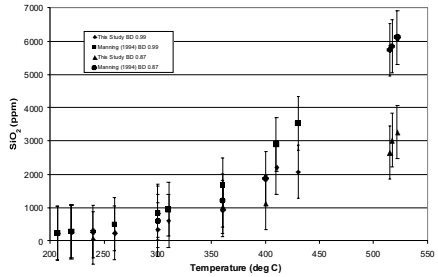

Figure 1: Solubility of quartz spheres

Figure 1 exhibits typical solubility data for bulk densities of 0.87 to 0.99. Our quartz solubilities are consistently smaller than those of MANNING (1994) and diverge significantly at temperatures greater than 400 deg C. The differences in our data may be attributed to errors in measuring the sphere diameters and the volume of water within the sample chamber.

The quantification of silica dissolution using micro-Raman spectroscopy has yet to be determined. Our preliminary results do however show that two silica species, H_4SiO_4 and $H_6Si_2O_7$, exist in solution (ZOTOV and KEPPLER, 2001). Raman spectra of standard solutions prepared from dissolved sodium silicate and silica gel will be used to correlate bandwidths and silica concentration.

References

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Defluoridation of drinking water by natural and synthetic clays

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The physiological effects of fluoride upon human health have been studied since the early part of the twentieth century. People depending on water with high concentrations of fluorine for their daily drinking water may develop fluorosis. This work deals with assessing the effect of adsorption of attapulgite, kaolinite, montmorillonite, and hydrotalcite-like anion clays (HT) and their calcined product (HT500) to remove fluorine ion from drinking waters. Attapulgite, kaolinite and montmorillonite used are natural samples, whereas HT was prepared by the co-precipitation method in laboratory and subjected to hydrothermal treatment, with samples heated to air temperatures of 80° (centigrade) and 130° (centigrade) for 24 hours.

Characterisation of fluorine sorption behaviour by these clays was achieved through absorption and equilibrium experiments, and shows that the fluorine sorption on the three natural clays can be described by Langmiur or Freundlich isortherm model, whereas the absorption of fluorine on the HT and HT500 was followed by absorption isotherms, quantitatively described by the application of the Henry equation. Factors found to influence fluorine sorption include the solution pH, crystallinity of $HTCO_3$ and the presence of exchangeable anions.