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Quantitative analysis of reactive transport processes in potential carbon sequestration reservoir rocks

We are currently using STELLA modeling software to quantitatively analyze reactive transport processes in potential carbon sequestration reservoir rocks. Having been observed to naturally occur in some deep geologic reservoirs, carbon sequestration is now being viewed as a feasible option for long term CO_2 storage. Therefore it is necessary to develop an understanding of fluid rock interactions in potential reservoir units, and the effect of super critical CO_2 on potential geologic reservoirs. We initially produced simple models of fluid flow through porous or fractured media, and will subsequently consider the more complex impacts of fluid-rock interactions (e.g. dissolution and precipitation rates of recrystallized minerals; changes to state variables (pressure and temperature) as water-rock reactions evolve; affects of rock strength in response to changing physical conditions). We are particularly interested in the effects of dissolution vs. precipitation on a fracture controlled vs. pore-controlled sample. Specifically how permeability will evolve in these two systems under both dissolving and precipitating system conditions. Using validated models we are testing different pressure and temperature conditions to predict the systems equilibrium constants and solubility curves. Model creation will be facilitated by 3-D Nuclear Magnetic Resonance (NMR) images to determine the porosity of the core and fractures present. Experimental data will be used to assess the validity of future models.