The combined effect of temperature and pH on albite dissolution rate under far-from-equilibrium conditions

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Understanding the variation of dissolution rate of silicate minerals in the critical zone has important implications for enhancing our knowledge on weathering reactions and many environmental problems. While one of the most studied aspects of weathering is the dependence of dissolution rate on pH and temperature, our present knowledge on how these enviornmental variables affects dissolution rate is mostly based on emperical rate laws.

In the present study, three new single point batch experimetns (SPBE) of albite dissolution were conducted under far-from-equilibrium conditions, pH 5 and three different temperatures (3.6, 25 and 50°C). The apprent activation energy (E_{app}) derived from these experiments is significantly different from E_{app} observed in previous studies under acidic conditions. Re-exmanition of data from previous studies shows that E_{app} of albite dissolution is pH depended.

Following Cama et al., [1] a rate law of the combined effect of pH and temperature on albite dissolution rate is proposed. The rate law that is based on theory [1], includes the adsorption isotherm of protons and hydroxyls on albite surface. The proposed rate law sucssefuly predicts albite dissolution rate under wide range of temperatures (3.6-300 °C) and pH conditions (1.3-11.75).

[1] Cama, J., V. Metz, and J. Ganor, *The effect of pH and temperature on kaolinite dissolution rate under acidic conditions*. Geochimica et Cosmochimica Acta, 2002. **66**(22): p. 3913-3926.