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# Kinetic Model of Zeolite Paragenesis in Tuffaceous Sediments

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**Abstract:** The sequence of mineral reactions involving zeolites and other authigenic phases in tuffaceous sedimentary rocks can be explained by growth- and dissolution-reaction kinetics. Kinetic factors may determine the specific authigenic phases which form and the temporal and spatial constraints on the solution composition during irreversible dissolution and growth reactions in glass-bearing rocks. The glass phase generates a high level of supersaturation with respect to a variety of aluminosilicates in the pore fluid. The sequence of assemblages formed during a series of metastable reactions resembles an Ostwald step sequence. Metastable reactions occur because formation of less stable phases such as gels, clays, and disordered zeolites may lower the total free energy of the glass-bearing system faster than the growth of the stable assemblage including ordered feldspars, quartz, and micas. Eventually, after a series of steps, the most stable silicate assemblage for the bulk composition, temperature, and pressure may form. However, the formation of intermediate metastable phases can delay the attainment of equilibrium by as much as tens of millions of years.

**Key Words:** Dissolution • Kinetics • Potassium feldspar • Thermodynamics • Tuffaceous sediments • Volcanic glass • Zeolites

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