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Al,Si order in albite and its effect on albite dissolution processes: A Monte Carlo study

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Abstract

The role of (Al,Si) disorder in the kinetics of albite dissolution is explored through parameterized Monte Carlo methods. Two dissolution mechanisms—multilayer leaching and single-layer retreat—were tested on 48 albite test configurations. In simulations involving multilayer leaching, dissolution rates increased with decreasing long-range order (LRO). We observed a fivefold maximum increase in dissolution rate tied to (Al,Si) disordering, roughly equivalent to that accompanying a decrease of 1.4 pH units at pH 1–5. This increase in rate due to disordering in albite is similar to that observed from compositional variation in plagioclase feldspars (An_{47} vs. An_0) at low pH. In contrast, (Al,Si) disordering had no discernible effect during the simulations involving the single-layer retreat mechanism. These results suggest that the effect of (Al,Si) disorder on albite dissolution rate is mechanism-dependent.

Keywords: Long-range order, short-range order, disorder, albite, Monte Carlo, dissolution mechanism, kinetics