
Dissolution Kinetics of Phlogopite. I. Closed System

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Abstract: Dry ground phlogopite was placed in deionized water saturated with CO₂ at room temperature and pressure. The bulk solution was buffered between a pH of 5 and 6 which is close to the pH of natural weathering systems. The conditions simulated a closed system. After 1010 hr, 2.0% of the total K, 0.95% of the Mg, 0.54% of the Si, and 0.74% of the F had been released, indicating that the dissolution was incongruent. Most of the K was released within 3 min, apparently by a rapid surface exchange with hydrogen ion. One-third of the cation-exchange capacity of this phlogopite arises from cations released from the outer surfaces, while two-thirds arises from the release of more deeply seated cations. All cations exhibited decreasing release with time, the slowest being Si. The rate-controlling "factor" in the later stages is related to the release of Si. It is difficult to distinguish linear from parabolic kinetics in the later stages because of the slow rate of dissolution; however, linear kinetics is most likely. If linear kinetics is applicable, the dissolution rate of Si was 3.8×10^{-17} mole/cm²/sec. Conclusions may be affected by the length of the experimental run.

Key Words: Closed system • Dissolution • Kinetics • Mica • Phlogopite

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