

THE LEACHED LAYER FORMED ON
WOLLASTONITE IN AN ACID ENVIRONMENT

by

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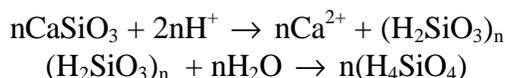
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ABSTRACT

Experiments were carried out in a fixed-bed external recycle mixed flow reactor to measure the rate of dissolution and the development of a leached layer on wollastonite. Each experiment ran for approximately 24 hours and the release rates of Si and Ca in the interval from 14 to 24 hours were analyzed. Each experiment began with an incongruent stage where Ca was released faster than the silica that remained on the surface to form the leached layer.

The silica release rate after 14 hours was $2.13 \times 10^{-9} (\pm 1.03 \times 10^{-9}, 1 \sigma, n=67)$ mol/m²/sec, and this rate appeared to be independent of pH from pH 2 to 6 at 25°C. BET surface area measurements of reacted wollastonite showed large increases in A_{sp} over the course of experiments even though both the Ca and Si release rates decreased. These large increases of measured A_{sp} were the result of the growing internal porosity of the leached layer, and much of this surface does not seem to contribute to Si release rates.

From these data, we infer that the overall reaction for the hydrolysis of wollastonite in an acid environment is best explained by two relatively independent reactions. First, Ca is removed from the crystal leaving behind linear silica polymers; then the silica polymers are released into solution where they hydrolyze to form H₄SiO₄.



As the leached layer grows in thickness, the Ca release rate slows because it is controlled by transport through the leached layer. A model of Ca diffusion through the leached layer shows that the leached layer grows thicker at lower pH and presents a longer diffusion path for Ca transport into the solution. This diffusion limited reaction offsets the faster rate of the Ca hydrolysis reaction so that at steady state the Ca rates should also become equal to the Si release rate.

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