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Using a mineral lifetime diagram to evaluate the persistence of olivine on Mars

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ABSTRACT

We present a diagram that shows the effect of pH, temperature, grain size, composition, hydrodynamics, and the laboratory/field discrepancy on the lifetime of olivine grains in weathering environments. Because the persistence of olivine grains on Mars can be used to constrain the duration of liquid water, we can use this diagram to predict a range of possible maximum contact times for olivine grains with liquid water before they dissolve away completely. Depending upon the physicochemical conditions, this contact time could range between a few thousand and several million years.

Keywords: Mineral lifetime, olivine, Mars, kinetics, water, dissolution rate, origin of life