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Temperature and timescales of alteration in chondrites : A nanoscale experimental study.

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The origin of water in the solar system is often inferred from the study of phyllosilicates in chondrites which requires the understanding of parent body serpentinization of amorphous silicates which are accreted in the matrix [1]. To constrain the temperature and timescale of the serpentinization, we conduct a kinetic study using a novel experimental setup and coupled analytical techniques. An amorphous, micron-thick layer (~ Fayalite 50) is deposited on a substrate and heated in water (60°C to 200°C, hours to days). TEM, rutherford back scattering (composition) and nuclear resonance analysis (H at.%) evidence a systematic sequence of hydrated amorphous layers: Mg-silicate on top, followed by iron (hydro)xide and Fe-silicate of serpentine composition. These materials result from kinetically controlled dissolution-precipitation processes. Simlarity with hydrated amorphous silicates in chondrite and fast reaction rates of the amorphous precursor may indicate shorter alteration episodes than previously thought, at low temperature.

[1] Brearley A.J. (2006) MESS II , 587–624.

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