Tiny but timely: Crystal surface reactivity constraints on diagenesis

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Quantitative variability of diagenetic alteration is a major challenge for the development of predictive concepts. Here, we focus on the nano- and microscopic variability of crystal surface reactivity as a major constraint to fluid-solid reactions [1]. While density and distribution of defect structures play a critical role, additional important impact is provided by the interaction of surfaces with nanoparticles and colloids during precipitation reactions [2]. Quantitative data are available from multiple surface-sensitive methods that provide mechanistic insight via reaction rate maps and rate spectra [3] and challenge the prevailing view that crystal dissolution is simply the inverse process of continuous crystal growth at crystal dislocations [4], e.g., during secondary porosity formation. Mechanistic insight is available from kinetic Monte Carlo methods, e.g., about inherited reactivity [5]. The upscaling of such simulation results to the pore scale is a challenging task that requieres novel numerical approaches [6]. Additionally to heterogeneities of the fluid flow field [7], reactive transport modeling approaches need to address ultimately the variability in surface reactivity in order to provide improved predictability.

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