Contribution ID: **300** Type: **Oral Presentation**

Probing Multiscale Dissolution Dynamics in Natural Rocks through Microfluidics and Compositional Analysis

Tuesday, 31 May 2022 17:15 (15 minutes)

Mineral dissolution significantly impacts many geological systems. Carbon released by diagenesis, carbon sequestration, and acid injection are several examples where geochemical reactions, fluid flow, and solute transport are strongly coupled. Yet, the dynamics of mineral dissolution and fluid-solid interaction remain poorly understood. The complexity in these systems involves interplay between various mechanisms that operate at time scales ranging from microseconds to years. Current experimental techniques only characterize dissolution processes using static images that are acquired with long measurement times and/or low spatial resolution. These limitations prevent direct observation of how dissolution reactions progress within an intact rock with spatially heterogeneous mineralogy and morphology. We utilize microfluidic cells embedded with thin rock samples to visualize dissolution with significant temporal resolution (100 ms) in a large observation window (3×3 mm). In this study, we injected acidic fluid into eight shale reservoir rock samples ranging from 8 to 86 wt % carbonate minerals. The pre- and post-reaction microstructures are characterized at the scale of pores (0.1 - 1 μm) and fractures (1 - 1000 μm). We observe that non-reactive particle exposure, fracture morphology, and loss of rock strength are strongly dependant on both the relative volume of reactive grains and their distribution. Time-resolved images of the rock cell unveil the spatiotemporal dynamics of dissolution in real-time and illustrate the changes in the fracture interface across the range of sample composition. The newly developed platform and experimental workflow provides real time characterization of geochemical reactions and has the potential to inform various subsurface engineering processes.

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References

Time Block Preference

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Participation

Online

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