# Direct observation of geochemical and geomechanical coupling in chalk

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The geomechanical impact of geologic carbon storage depends on the structural sustainability of the chosen reservoir, as well as the probability of buoyancy driven $CO_2$ leakage through caprocks. The dissolution of porous media in an imposed flow field can undermine the mechanical stability of formations. Here we show, with a combination of *ex situ* nanotomography and *in situ* microtomography (Figure 1), that the presence of dissolved $CO_2$ in water produces a homogeneous dissolution pattern in chalk microstructure. This pattern results from solubility of the rockstructure by the injected fluid. Three geomechanical impacts were observed experimentally: material compaction, fracturing and grain relocation. These phenomena demonstrated distinct feedbacks to the migration of the dissolution front, making it less susceptible to spatial and temporal perturbations in the strongly coupled geochemical and geomechanical processes.

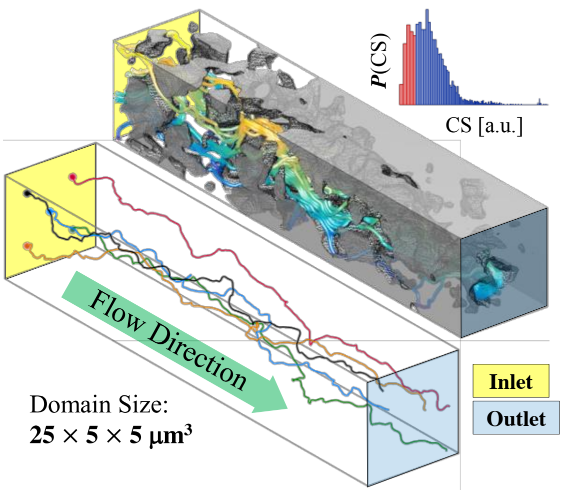


**Figure 1** Chalk microstructure at the point of breakthrough (upper right) and 5 streamlines originating from the fluid inlet. Imposed on the microstructure, are the streamlines that have been calculated based on the initial flow field. The inset shows the distribution of the cumulative surface (CS), calculated from 40,000 streamlines originating from the fluid inlet. P represents the normalized density function of CS. Only the streamlines within the lowest 10% of the CS (red bars) are drawn.