Abstract Submitted
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Physical model of a dissolving porous media in a fluid flow[1] RAM SUDHIR SHARMA[2], ARSHAD KUDROLLI[3], Clark University — We investigate the interaction of fluid flow and dissolution of a porous media with experiments and complementary numerical simulation toward understanding the formation of underground caves and channels. We use caramel as the solid matrix because of its relative transparency and rapid dissolution rates. Solid caramel blocks are molded within 3D microfluidic chambers with prescribed shapes to have a well-defined solid matrix, and fluid sources and sinks. The experimental apparatus is transparent, allowing us to image the solid phase as it dissolves in real time. A non-dissolving phase is added to introduce further inhomogeneity in the system. A numerical simulation of the three-phase system and a dissolution rate proportional to the local flow speed and solid fraction of the dissolving phase is demonstrated to capture the evolution of the system with simplified geometries. The calibrated model is then used to understand the evolution of systems as a function of heterogeneity and fluid injection rates. We further discuss the role of gravity in leading to instabilities that cause dissolution patterns with unexpected shapes.

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