**Invariantly propagating dissolution fingers in finite-width systems**

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# **ABSTRACT**

Dissolution fingers are formed in porous medium due to positive feedback between transport of reactant and chemical reactions [1-4]. We investigate two-dimensional semi-infinite systems, with constant width in one direction. In numerical simulations we solve the Darcy flow problem combined with advection-dispersion-reaction equation for the solute transport to track the evolving shapes of the fingers.

We find the stationary, invariantly propagating finger shapes for different widths of the system , flow rates and reaction rates. Shape of the reaction front, turns out to be controlled by two dimensionless numbers – the (width-based) Péclet number and Damköhler number , where is the reaction rate, – specific reactive surface area, - characteristic flow rate, – diffusion coefficient of the solute, and – initial porosity of the rock matrix. Length of the stationary finger turns out to be proportional to . Velocity of propagating front in initial stages of finger formation as a function of system parameters is also calculated.

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| *Fig. 1 Dissolution finger in the limestone quarry in Smerdyna (left) and porosity obtained in simulation for Péclet number and Damköhler number (right). Inset shows close-up of the dissolution front.* |  |

**References**

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