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Scaling a two-phase flow problem: Laetitia helping Alexis to escape a daily headache

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Fluids are ubiquitous in the Earth lithosphere. Their propagation is thought to occur at small time scales (days-hundred of years) compared to the deformation of the lithosphere. Coupling such system is of prime interest to understand for example the risk assessment related to subsurface waste storage or the prediction of ore deposit location related to aqueous or magmatic-derived fluids. However challenges arise from the material parameters such as porosity, permeability or viscosity (both of the matrix and the fluid) that range over several order of magnitude and the contrast of time scales between phenomenon. To do so I use a finite difference non-dimensional code to solve both for the deformation of a viscous porous matrix and the pore fluid motion.

Here I present the difficulties I have to scale such two-phase flow problem in a system representing the emplacement at lower to upper crustal scales of pegmatite melts (with viscosity ranging between 10^1 to 10^{13} Pa.s).

Amongst other the problems I have come from (i) the few natural data available on the time scale of pegmatite emplacement, (ii) the variability of thickness of the pegmatites observed in the field (from a few mm to a kilometre) (iii) the assessment of permeability of the host rock (iv) or the difficulties to solve a problem with parameters value far form unity.