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Flow and fracturing conditions before the segmentation of experimental dikes

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The uprise of magma dikes that split in branches are regularly outcropping as en echelon structures, segmented dikes, or finger like intrusions are documented examples. Dike segmentation and finger formation at different scales have been attributed commonly to effects of the host rock: 1) crustal heterogeneities that interact with the magma such as faults, fractures, and joints; 2) local rotation of the principal stress axes orientations during emplacement; 3) changes in the host rock elastic properties due to chemical corrosion, unconsolidation and weathering. Less attention has been devoted to the effect of the magma flow in leading to segmentation and formation of fingers, but the effect of fluid flow might be relevant due to the complex flow dynamics of magmas. In past experiments presented by Chavez-Alvarez et al. (2020a) and Chavez-Alvarez and Cerca (2020b), he relevance of viscous forces in hydrofracturing was analyzed by quantitatively comparing the evolution of experimental dikes of contrasting rheology (Newtonian and shear thinning), where segmentation was documented for the case of shear thinning fluids. Here we provide an analysis of the hydrofracturing conditions that prevail before the segmentation of hydrofractures that transport shear thinning fluids. We evaluated parameters of toughness and viscous regimes in conditions of the hydrocrack inception, early development and propagation before segmentation. Furthermore some aspects of the flow such as Reynolds number and flow trajectories inside the experimental dikes are presented.

References

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