SUPPLEMENTARY MATERIAL VOLCANICA

Supplementary Material for:

# Dynamics of magmatic intrusion: what can we learn from the comparison of analog and numerical models?

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## INFLUENCE OF BOUNDARY CONDITION AT THE TANK WALL ON CRACK OPENING

We used the commercial software COMSOL to compute the stress field generated by the opening of the crack head, considering a boundary condition of zero displacement at the tank wall. Specifically, we calculated this stress field using the parameters of EXP2105-I4, where 50 mL of oil was injected into hole 5, located 12 cm from the lateral wall. The calculations were conducted with the crack located 2 cm below the surface, under two conditions: one considering the actual dimensions of the experimental tank and another simulating a tank twice as large.

We modeled the crack opening of a static Weertman crack [Secor and Pollard 1975], matching the observed length, which is always larger than the opening of a dynamic crack head [Furst et al. 2023]. The resulting maximum compressive stress around the crack is oriented perpendicularly to the opening. Figure S1a and S1b illustrate this maximum compressive stress within the vertical plane perpendicular to the crack ($Y$=0) for the two distinct tank sizes, while Figure S1c displays the stress difference between these cases. The impact of the gelatin's fixed displacement at the tank walls on the internal stress field around the crack is significant only in a small area localized above the crack tip. Hence, we maintain confidence in the limited influence of this effect on crack propagation.

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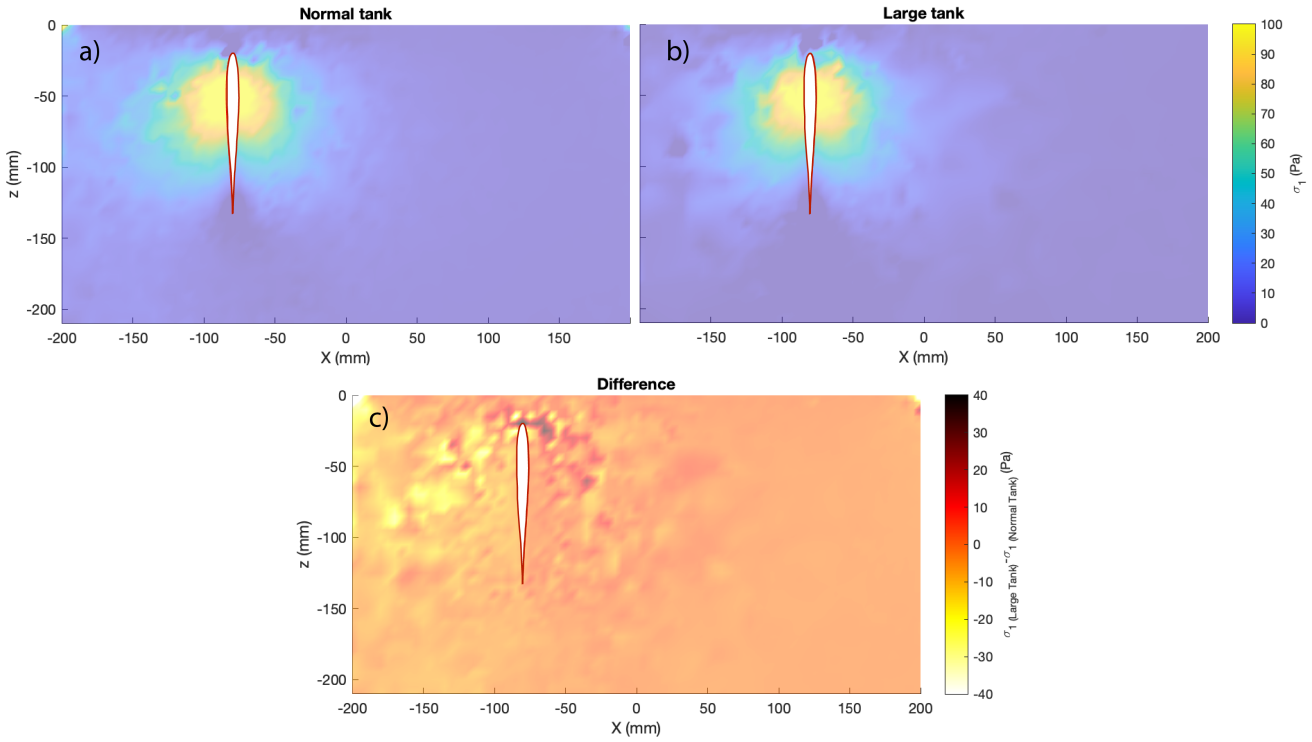


Figure S1: Amplitude of the maximum compressive stress (positive value for compression) induced by the opening of a Weertman crack (white shape) representing the largest crack from the analog experiments. The crack tip is located at 2 cm below the gelatin's surface. COMSOL simulations were performed for a gelatin block with dimensions a) $L_t \times l_t \times H_t$ = 40 × 20 × 22.5 cm ("Normal Tank") and b) $L_t \times l_t \times H_t$ = 80 × 40 × 50 cm ("Large Tank"). c) Difference between the "Large tank" and the "Normal Tank".

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## References

Furst, S., F. Maccaferri, and V. Pinel (2023). "Modeling the Shape and Velocity of Magmatic Intrusions, a New Numerical Approach". In: *Journal of Geophysical Research: Solid Earth*. DOI: 10.1029/2022JB025697.

Secor, D. T. and D. D. Pollard (1975). "On the Stability of Open Hydraulic Fractures in the Earth's Crust". In: *Geophysical Research Letters* 2(11), pages 510–513. DOI: 10.1029/GL002i011p00510.