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THE ROLE OF FLUIDS IN EARTHQUAKE CYCLES: INSIGHTS FROM SEISMO-HYDRO-MECHANICAL MODELS

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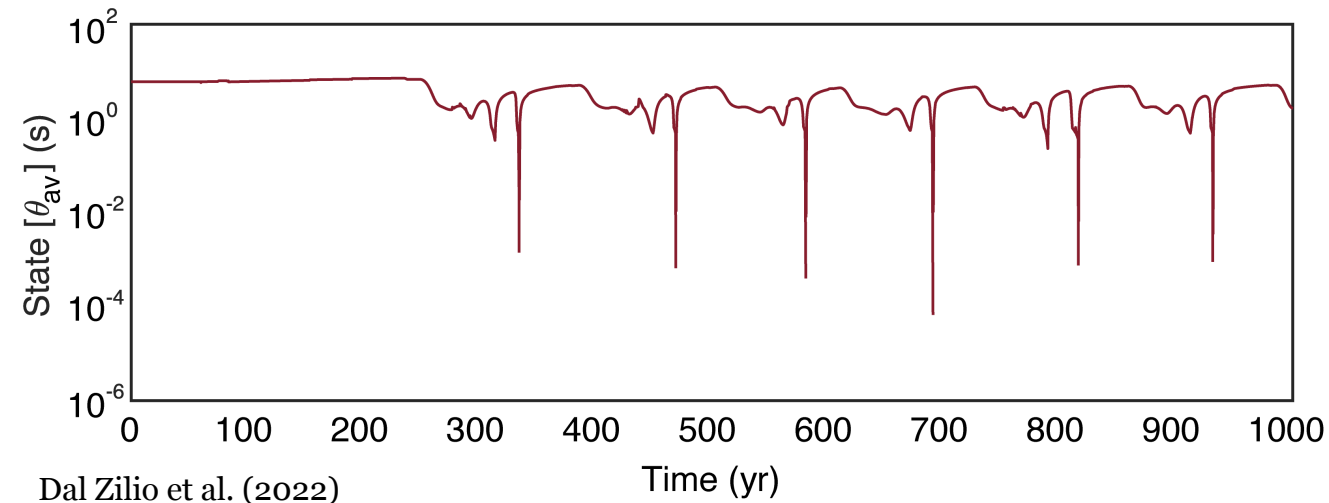
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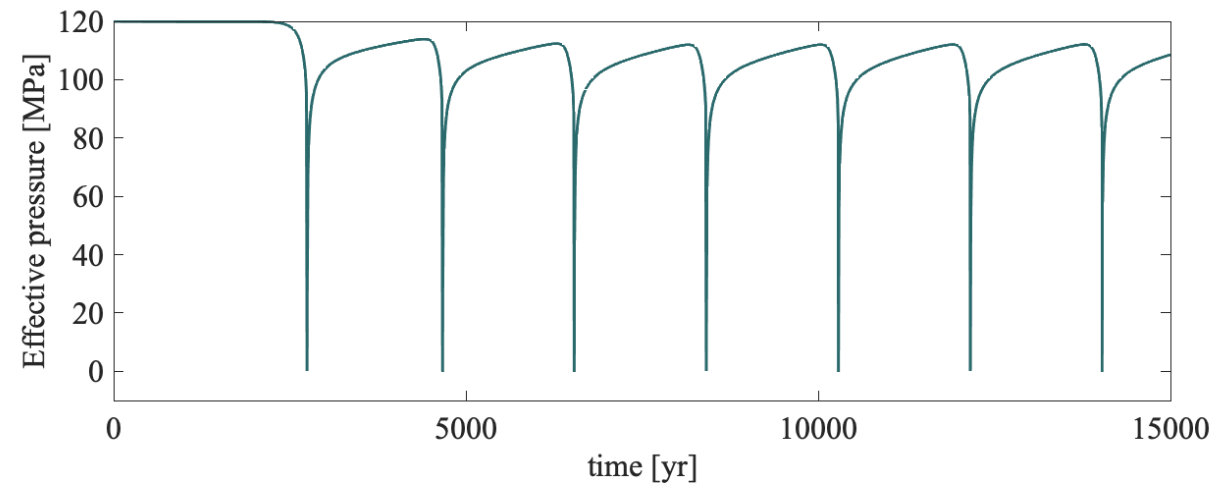
Seismo-hydro-mechanical modeling

Rate and state friction



$$\sigma_{II} = \sigma_0 \left(f + a * \ln \left(\frac{V}{V_0} \right) + b * \ln \left(\frac{V_0 * \theta}{D} \right) \right)$$

Rate strengthening yield strength



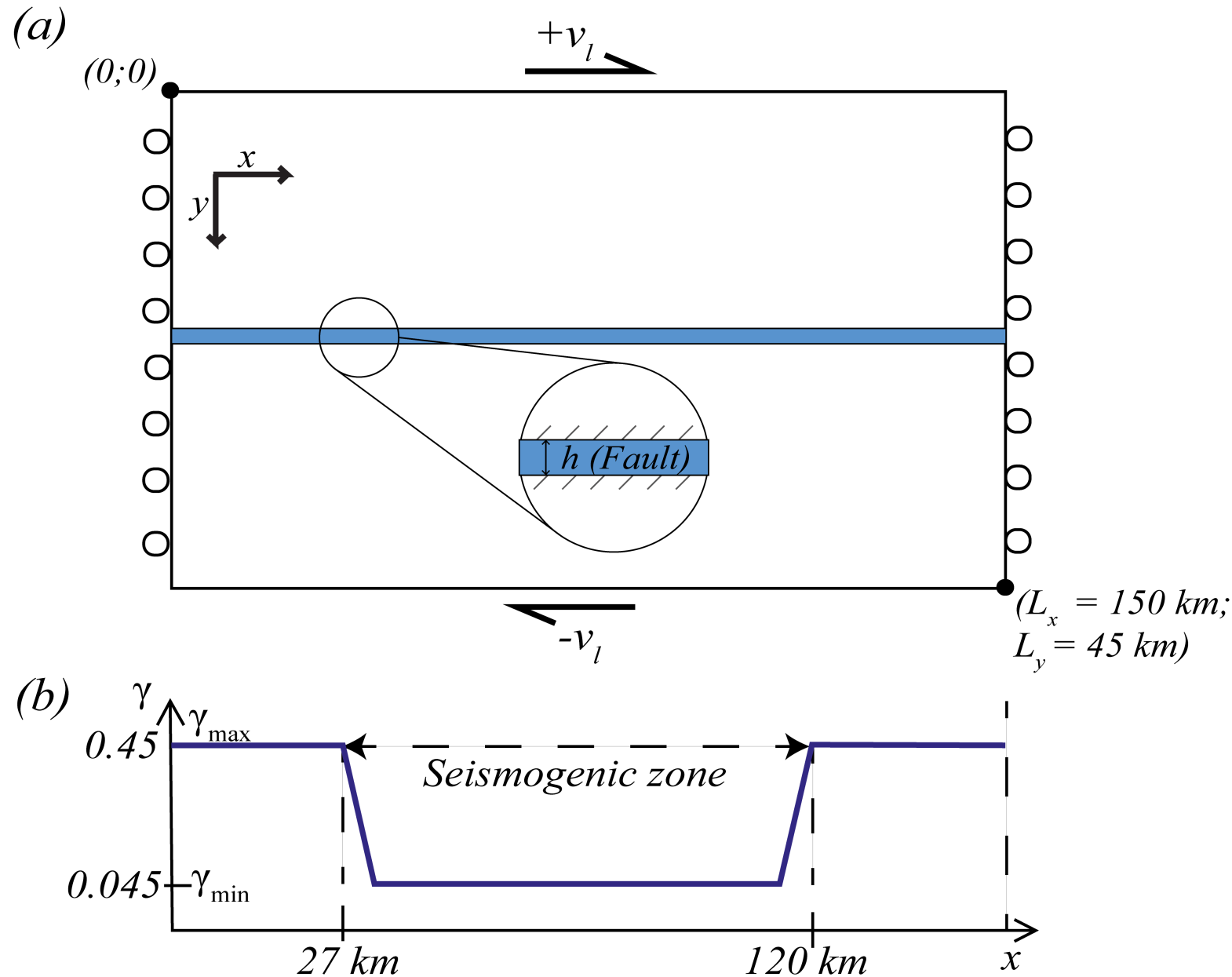
$$\sigma_{II} = \sigma_0 \left(\frac{\dot{\epsilon}'_{II(plastic)}}{\epsilon_0} \right)^\gamma$$

$$\sigma_0 = c + f(p_t - p_f)$$



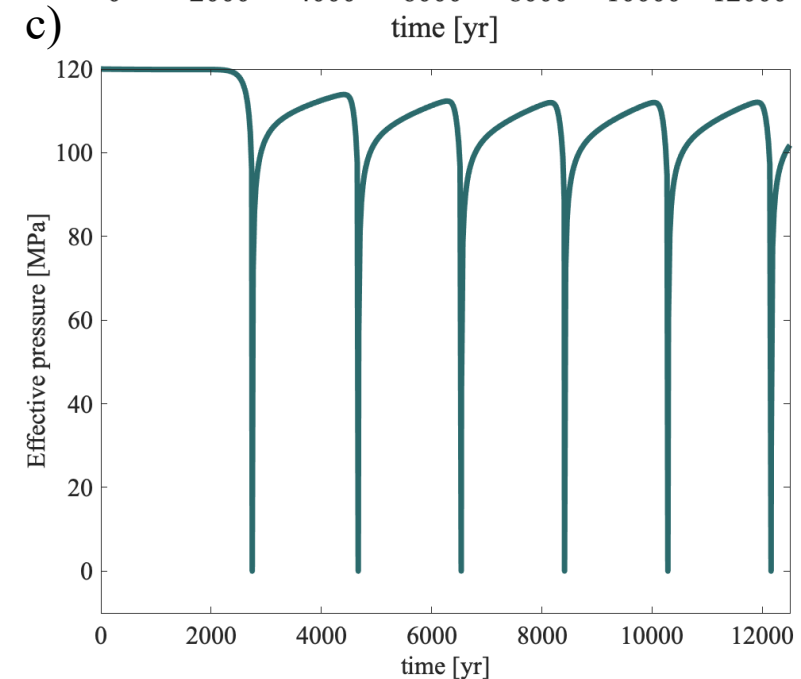
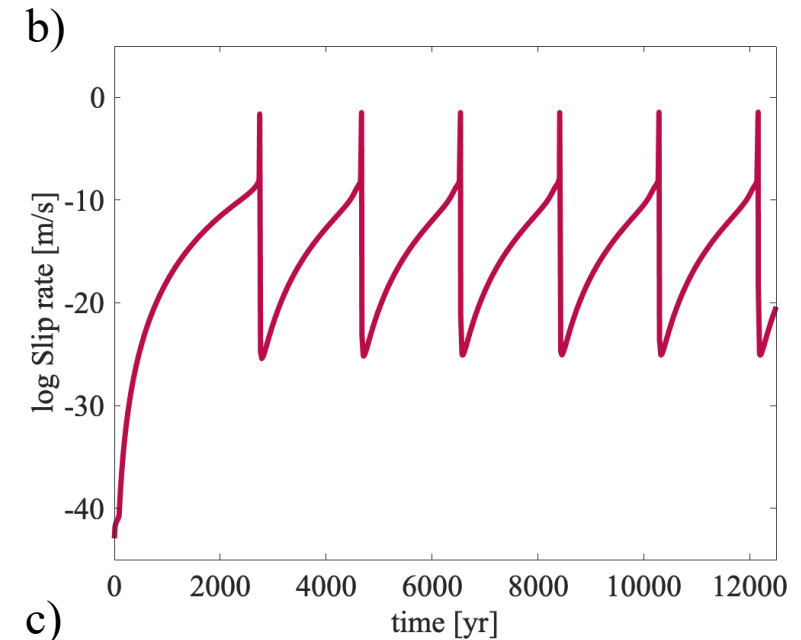
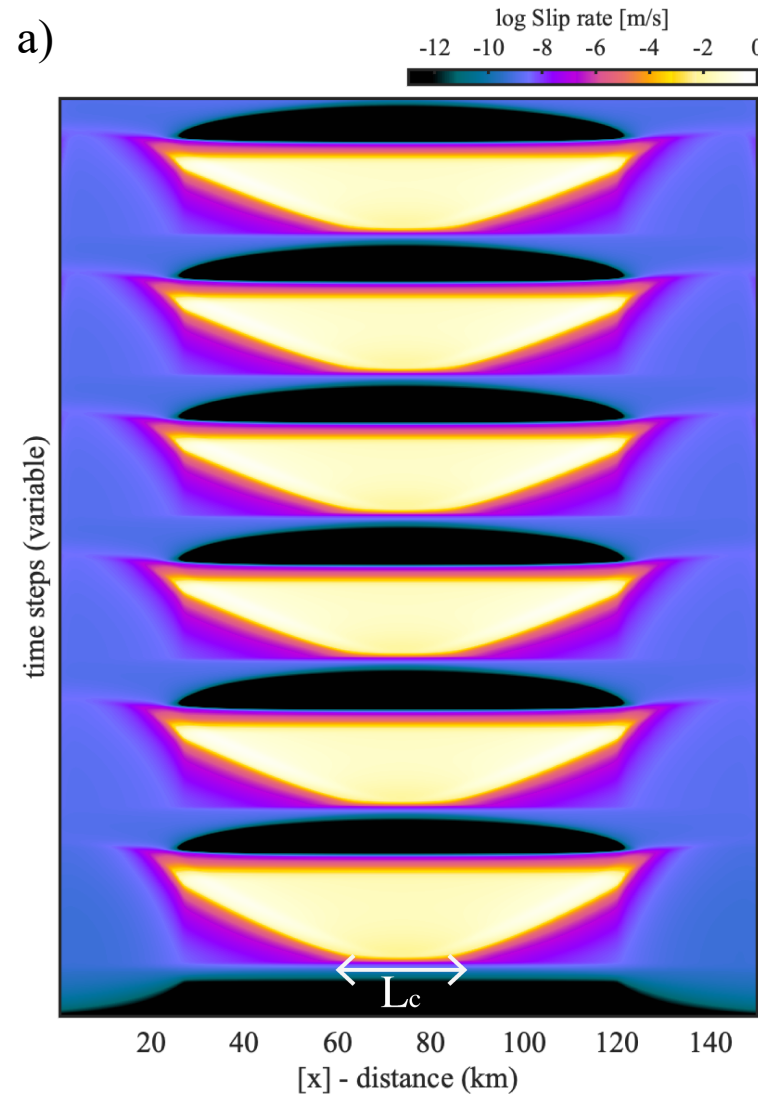
Model setup

- Strike slip fault in a poro-visco-elasto-plastic medium
- No lithological heterogeneities



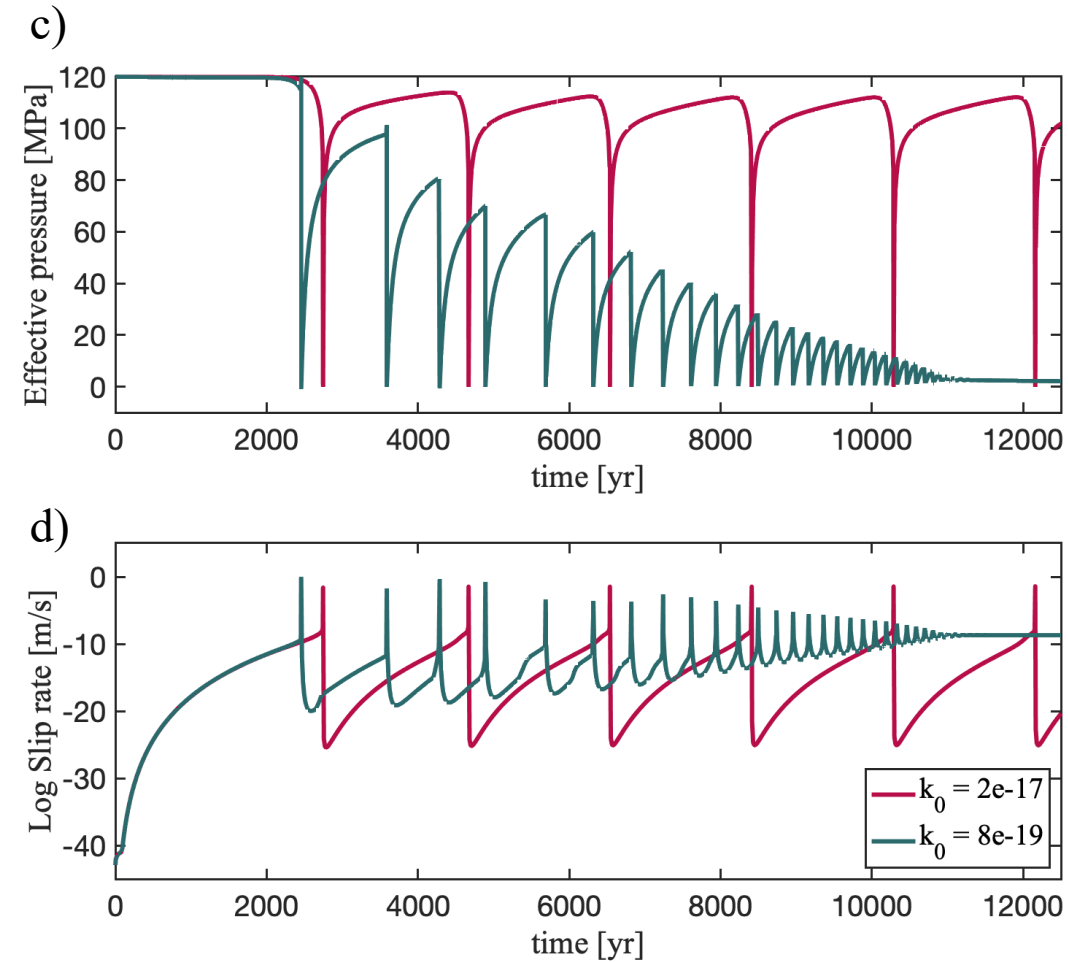
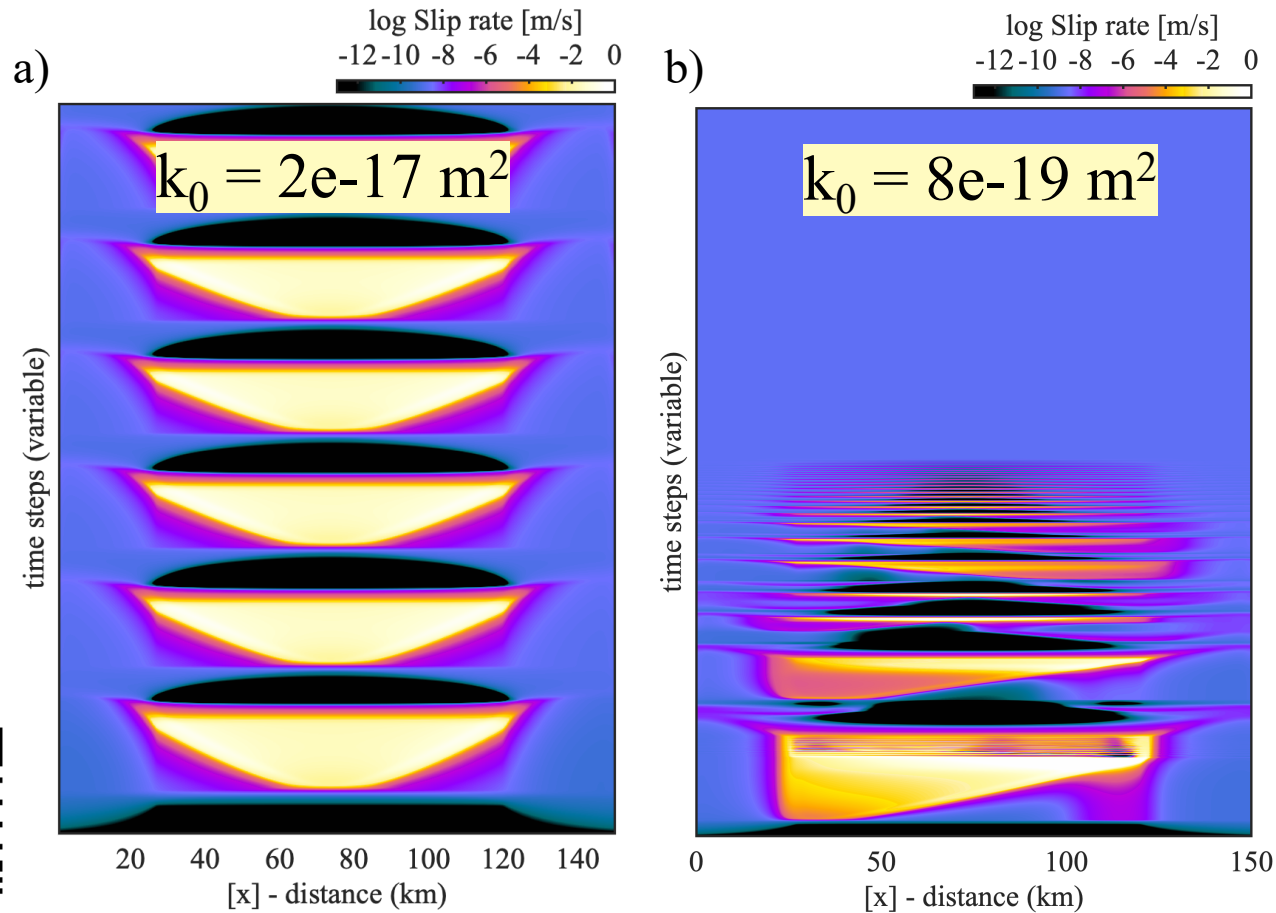
Reference model

- Nucleation in the middle of the fault
- Complete ruptures
- Slip rate $\sim \text{ms}^{-1}$ magnitude



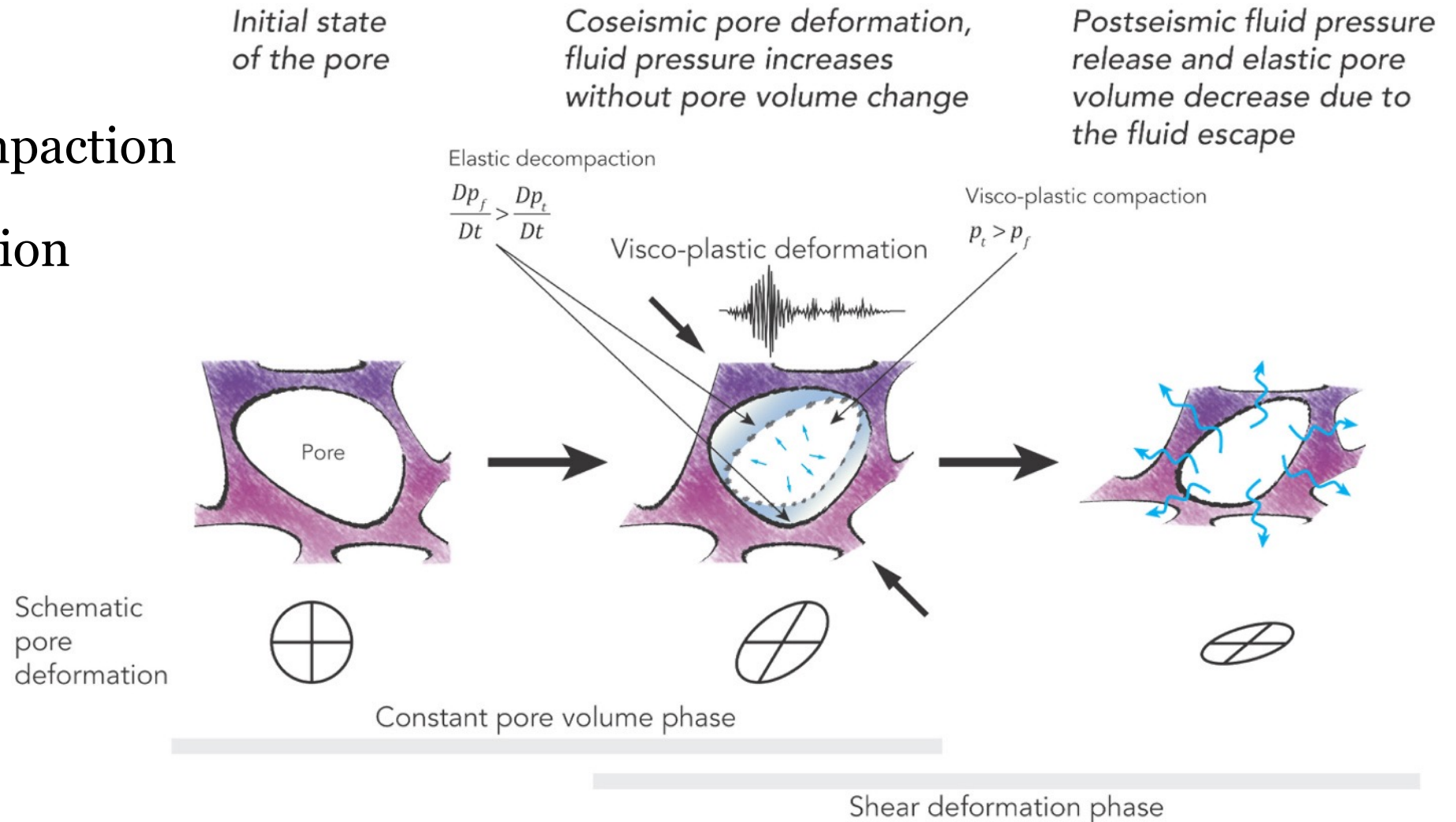
Permeability controls on seismicity

- Porosity dependence $k = k_0 \left(\frac{\varphi}{\varphi_0} \right)^3$



Summary

- Visco—plastic compaction
- Elastic decompaction
- Fluid release

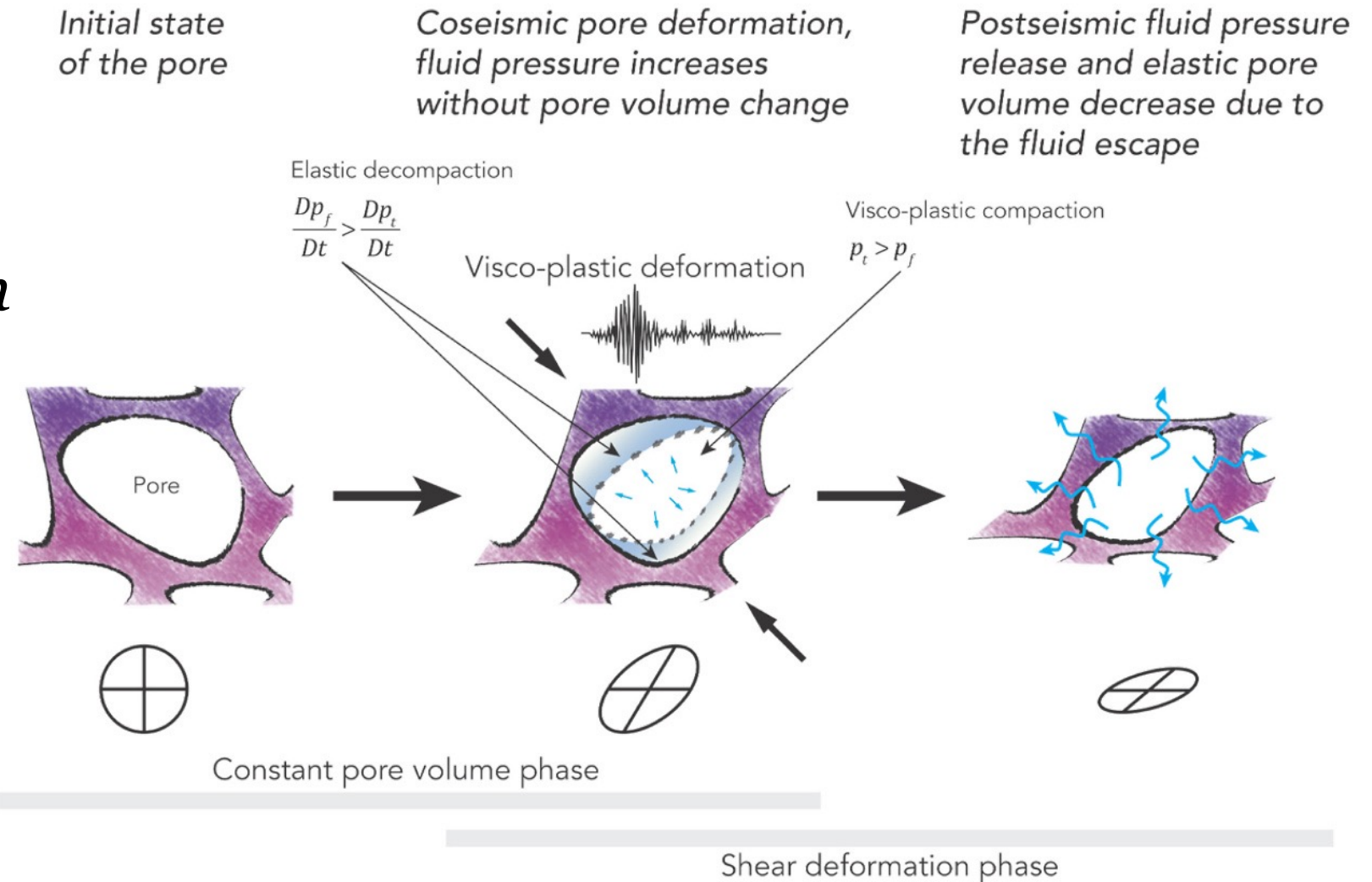


Petrini et al. (2020)

*Thank you for
your attention!*

Discussion:

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Petrini et al. (2020)

