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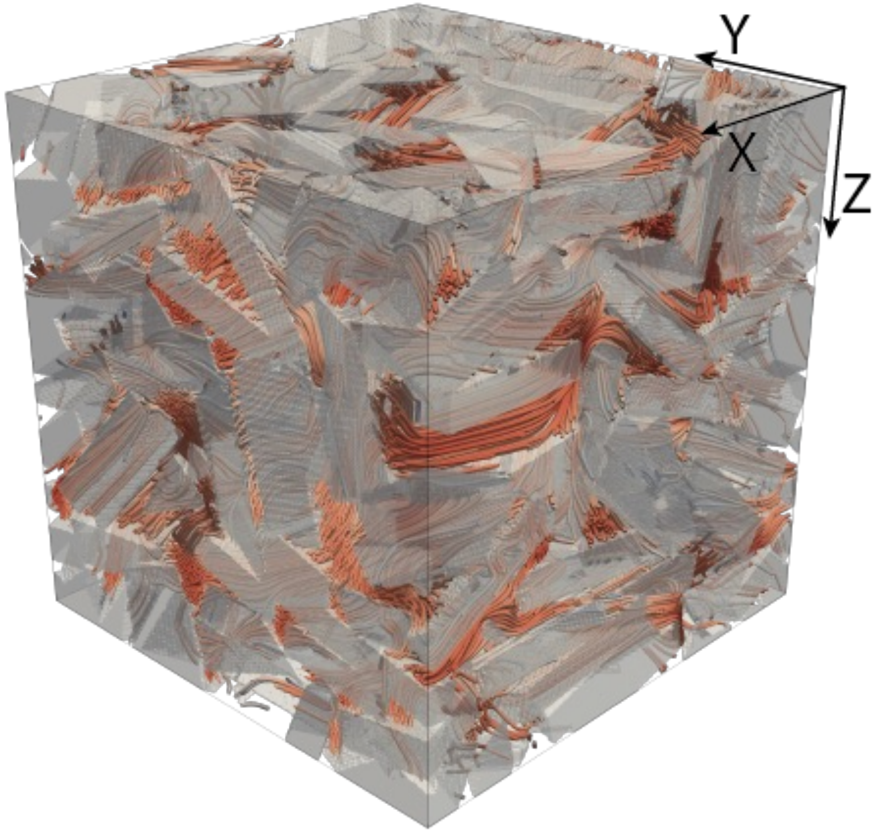
LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

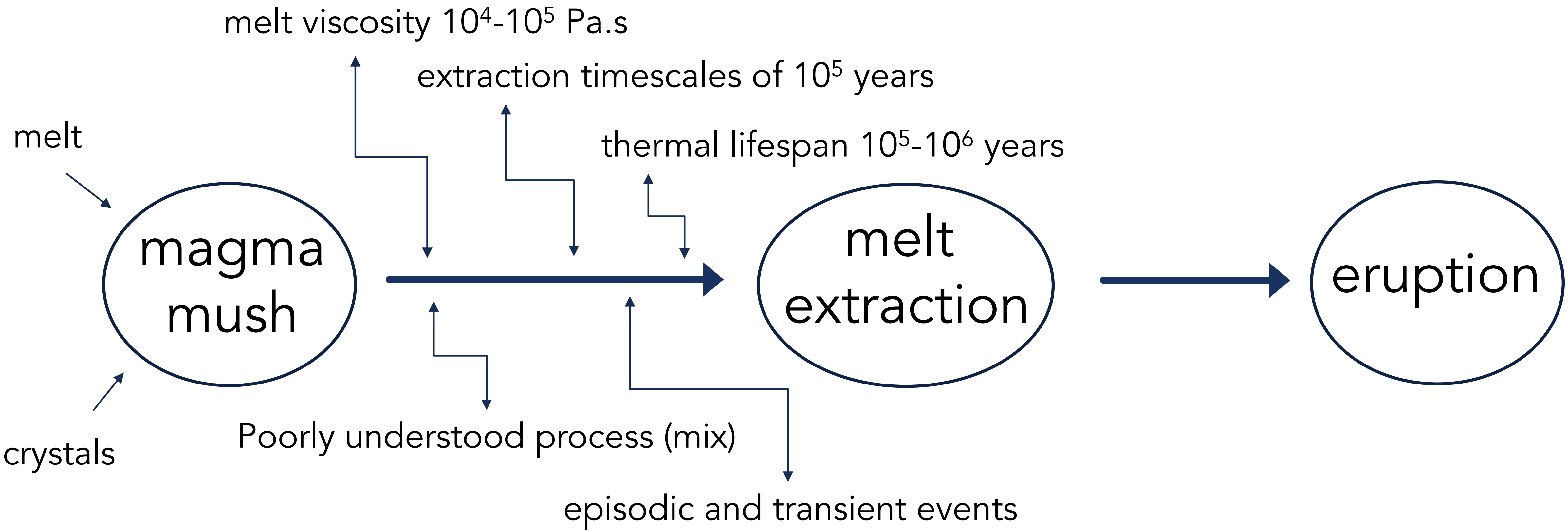
University of Strathclyde Glasgow

The permeability of loose magma mush



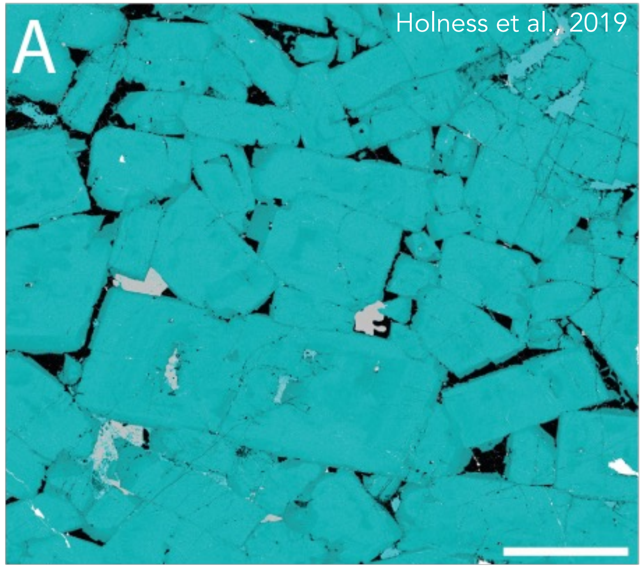
Eloïse Bretagne, F. Wadsworth, J. Vasseur, D. Dingwell, K. Dobdson, M. Humphreys, S. Rooyakkers

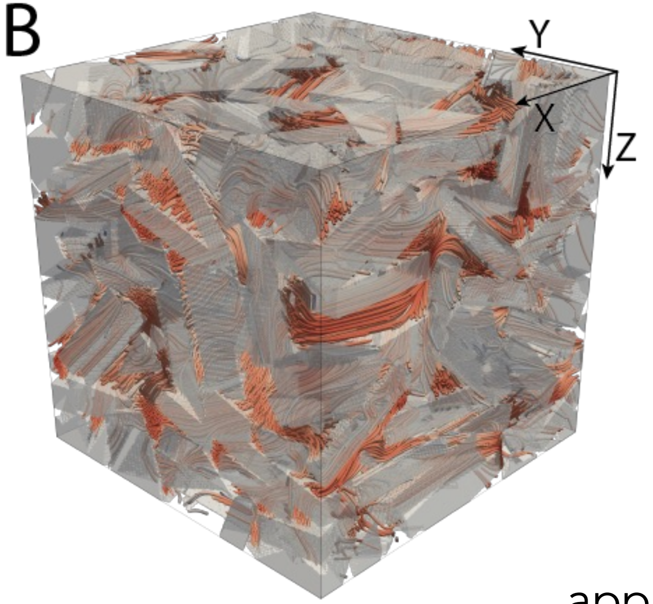
MELT EXTRACTION PROCESSES



sensitive to crystal framework permeability

NUMERICAL CUBOID PACKS TO SIMULATED CRYSTALS FRAMEWORK OF MUSH





Darcy's law, $\nabla P = -\mu_f Q/(kA)$

$$k = \frac{(1-\phi)^3}{Cs^2}$$

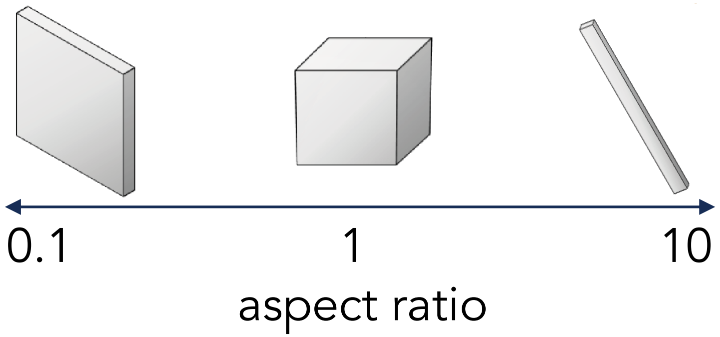
$(1-\phi)^3$ → packing fraction, #crystals/vol

s^2 → specific surface area, S_{tot} / V

Numerical, densely packed, randomly oriented cuboid domains (Lui et al., 2017)

Defined by their aspect ratio

At maximum packing fraction



apply numerical lattice-Boltzmann fluid flow simulation tool -> outputs permeability

PERMEABILITY RESULTS AND MODEL

permeability is a function of ϕ, s

normalised k data fits the model with <u>no fitting parameters</u>

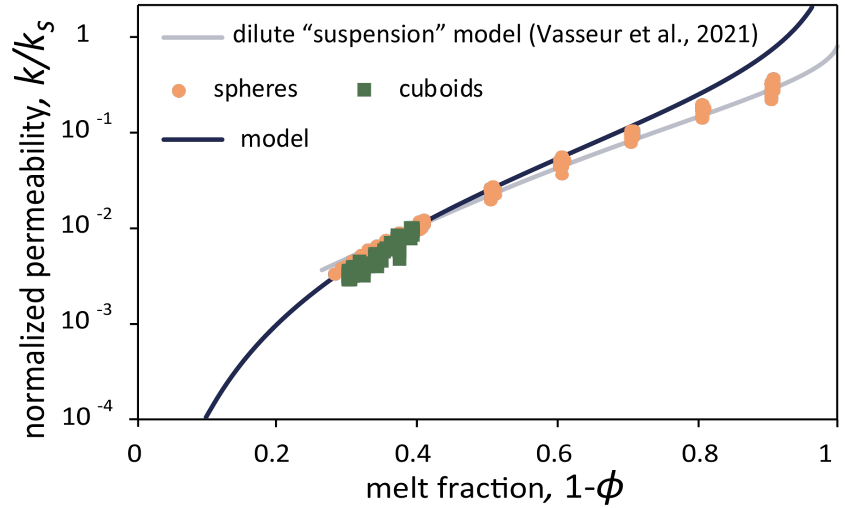
cuboids are at maximum packing fraction, but still see spread in data

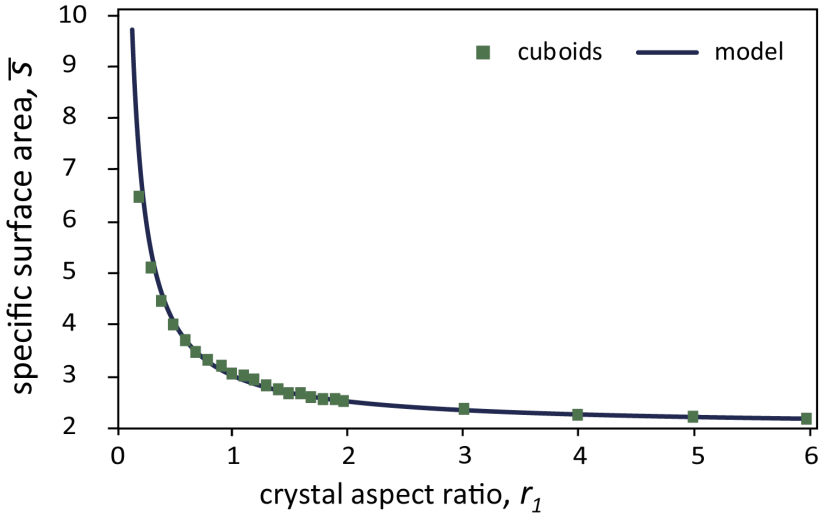
➡ due to the shape (aspect ratio)

specific surface area is function of crystal aspect ratio

$$k = \frac{(1-\phi)^3}{Cs^2}$$

$$s = \frac{2(\phi)}{a}\left(1 + \frac{1}{r_1} + \frac{1}{r_2}\right)$$



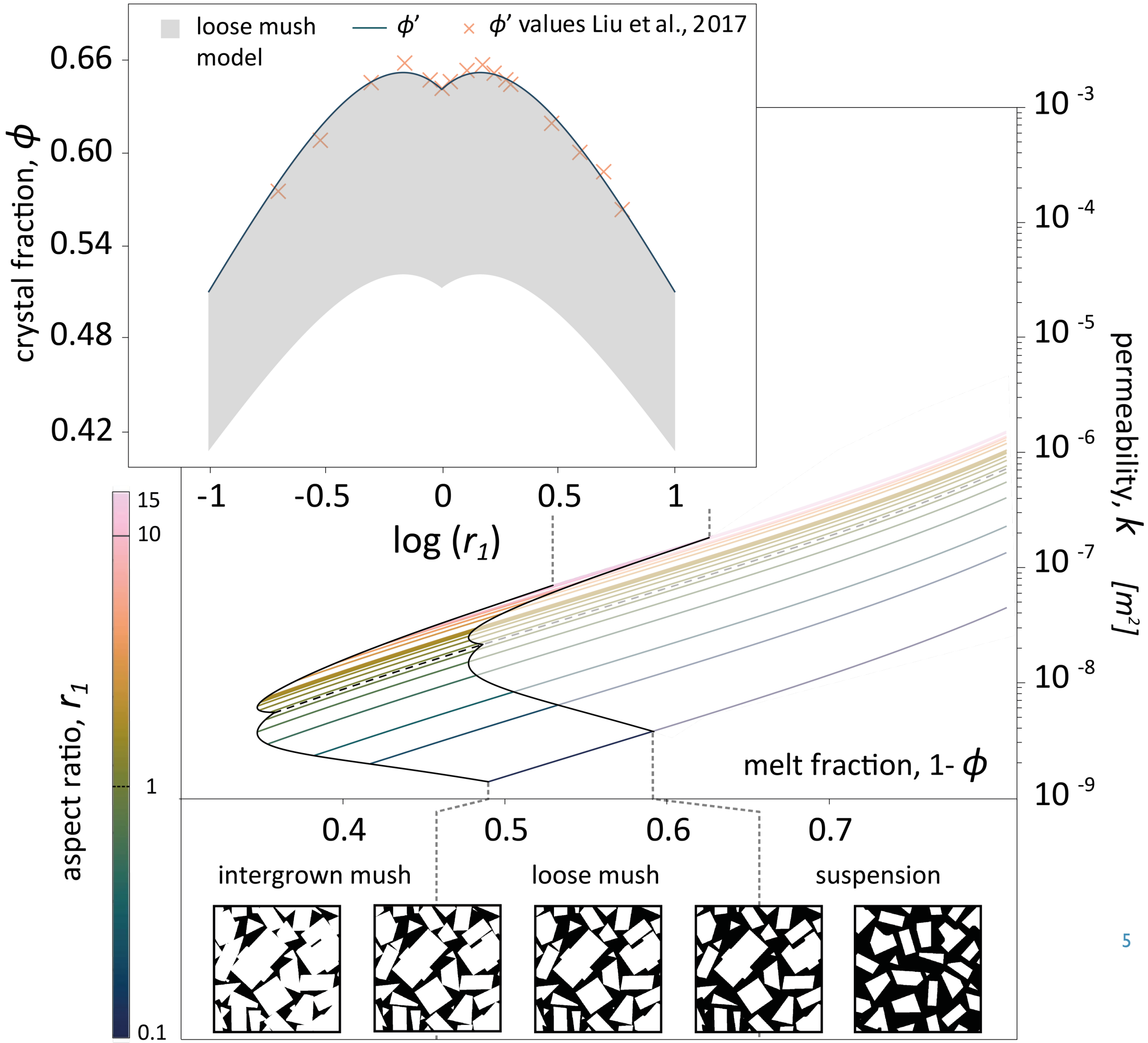


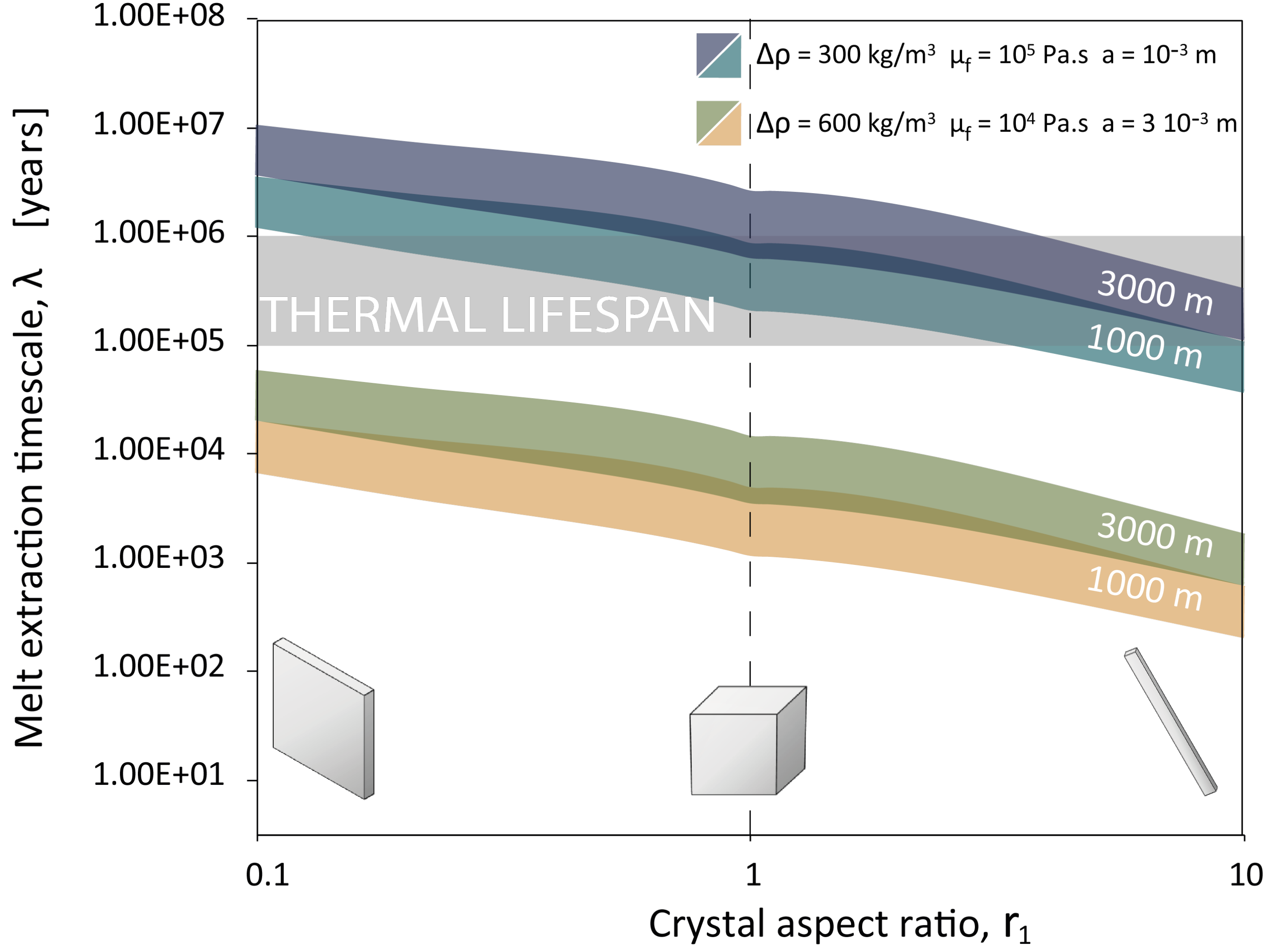
APPLICATIONS OF PERMEABILITY MODEL

Crystal shape affects

- permeability
- maximum packing fraction

➡ model accounts for both effects





EXTRACTION TIMESCALES FOR COMPACTION

Implications for extraction timescales using compaction theory

Timescales sensitive to crystals shape

➡ Need to account for crystal shape

Disclaimer: we do not believe that compaction is the main driving force in melt extraction!

Thank you for your attention!

If you have any further questions, don't hesitate to contact me at

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Look out for our paper!