

Low-Reynolds number settling of spheres through fluid interfaces

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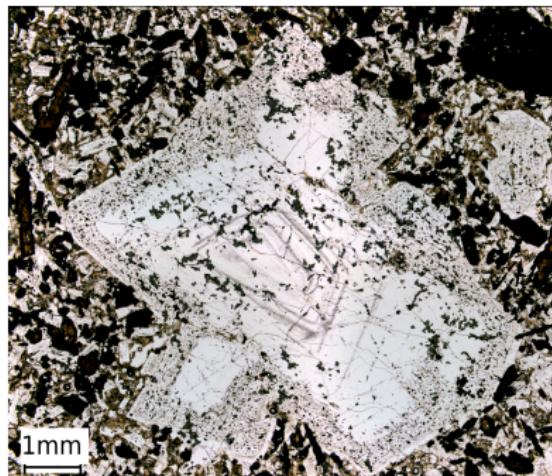
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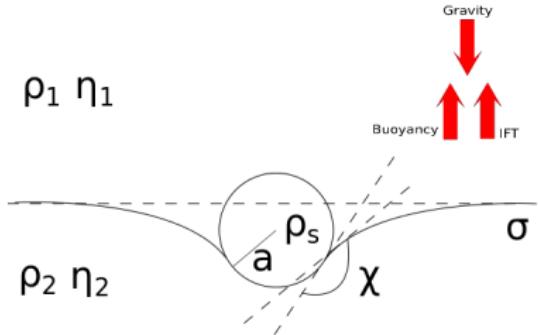
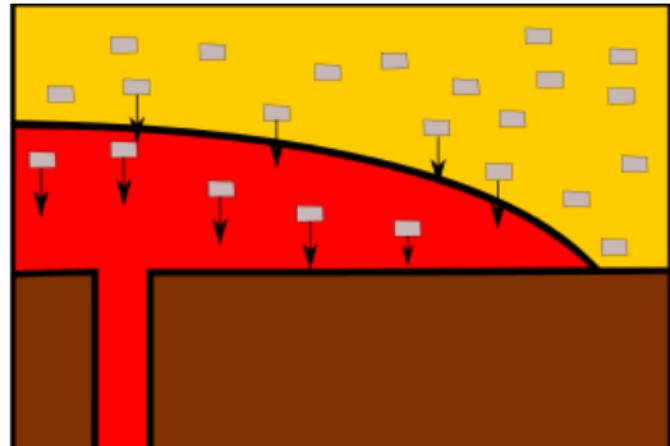
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Motivation: Magmatic xenocrysts

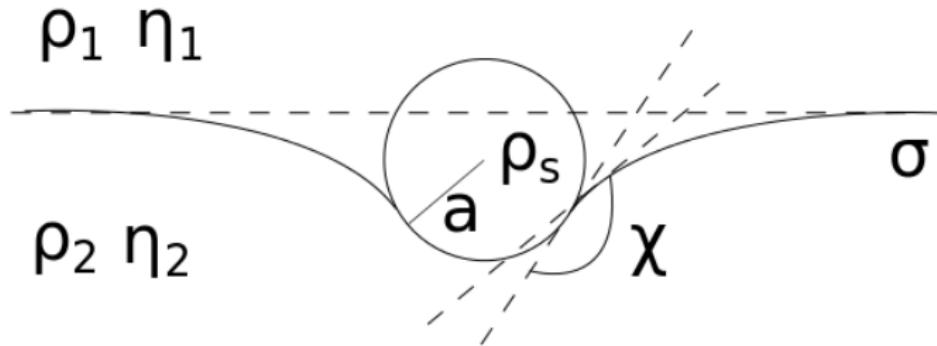


Gravitational Settling



- $\rho_{1(2)}$ = Density of fluid 1(2)
- $\eta_{1(2)}$ = Viscosity of fluid 1(2)
- σ = Interfacial tension (IFT)
- a = Radius
- ρ_s = Particle density
- χ = Contact angle

Dimensionless Parameters



Bond Number

Modified Density Ratio

Viscosity Ratio

$$Bo = \frac{(\rho_2 - \rho_1)ga^2}{\sigma}$$

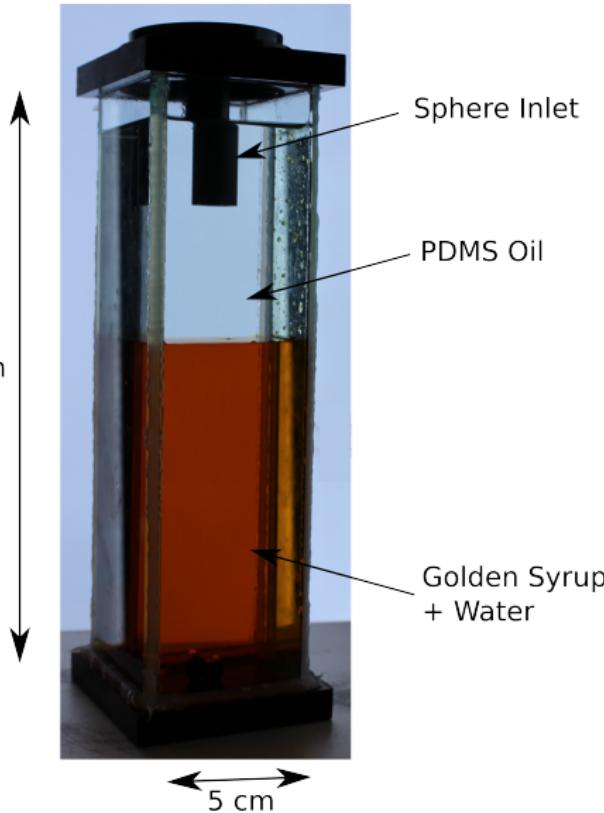
$$D = \frac{\rho_s - \rho_1}{\rho_2 - \rho_1}$$

$$\lambda = \frac{\eta_2}{\eta_1}$$

Questions

- For what conditions is sinking associated with entrainment of upper phase fluid?
Consequences for magma hybridisation
- What is the timescale of sinking?
Important if other timescales matter e.g. solidification

Experiments



Glass spheres of various radii 2-10 mm

Water content in syrup from 0-5%

Grade of PDMS oil

Temperature from 0-32°C

Can achieve ranges:

$$0.1 \leq Bo \leq 5$$

$$10^{-2} \leq \lambda \leq 10^3$$

$$D \approx 3.3$$