Detachment of colloids at a swelling clay-water interface: *Conclusions based on rheological measurements*

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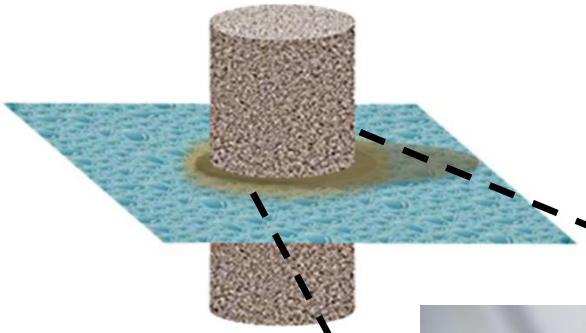
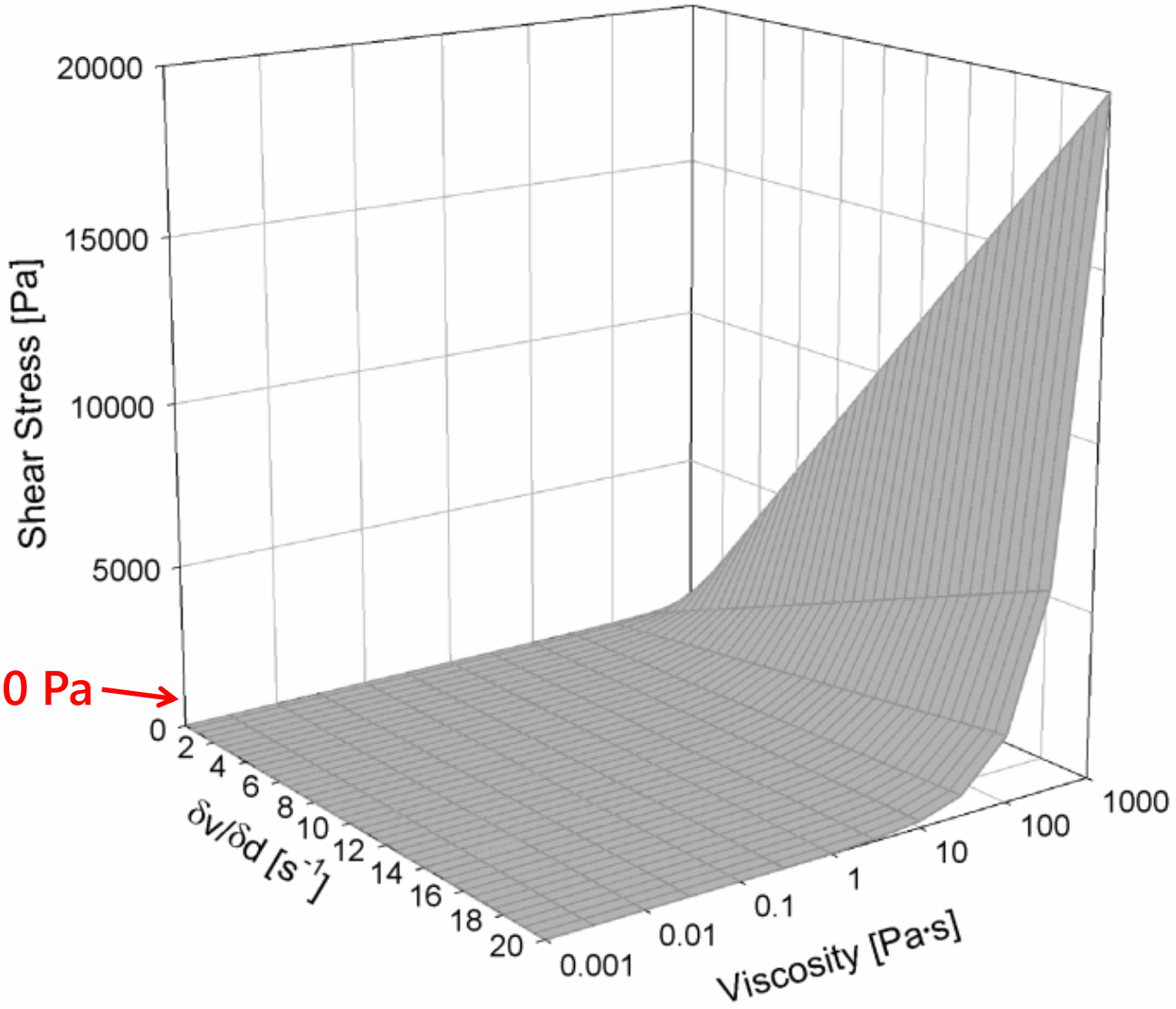
Background



Detachment mechanism?

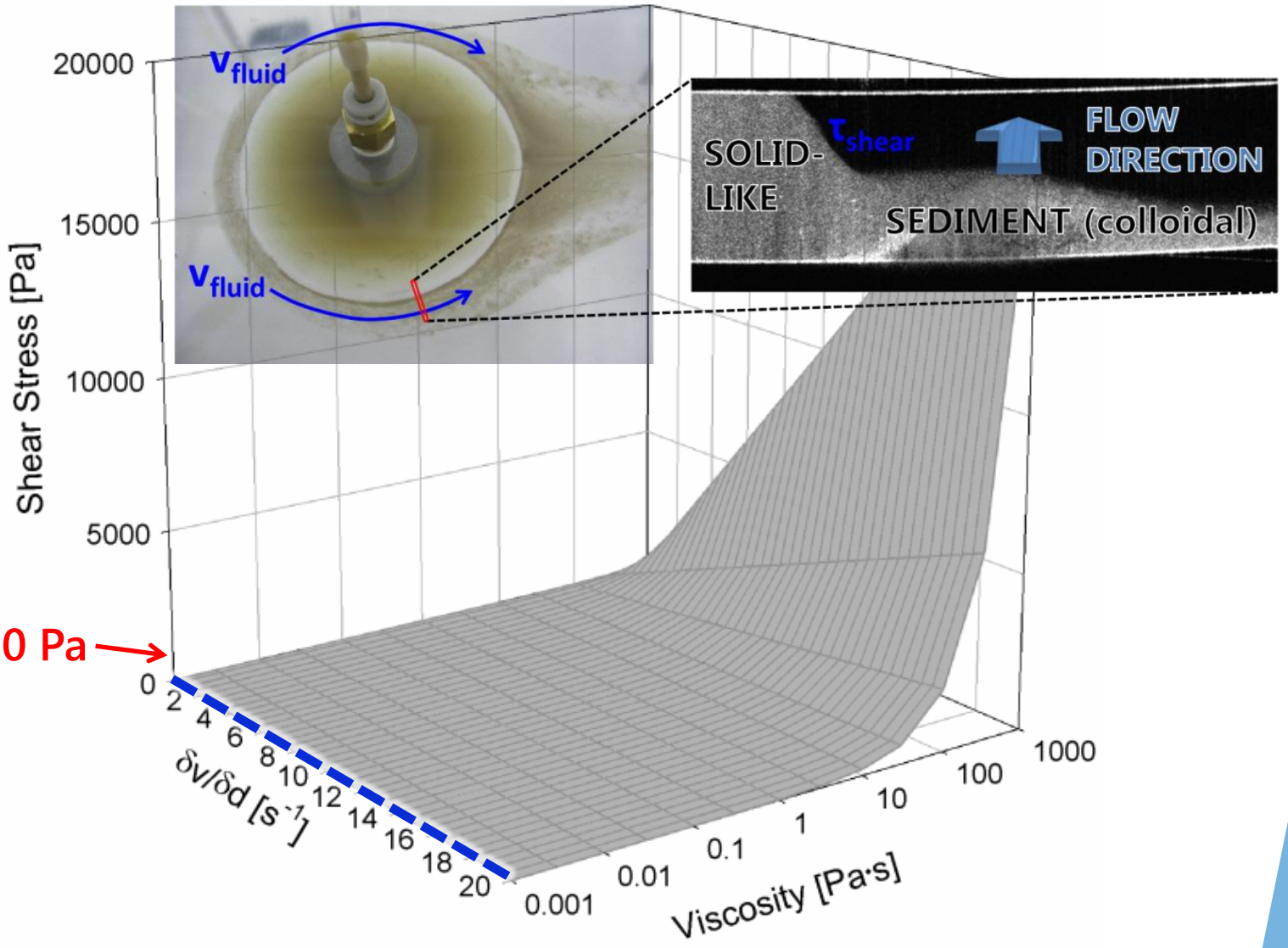
Shear stress



$\tau_y \geq$ ~100 Pa

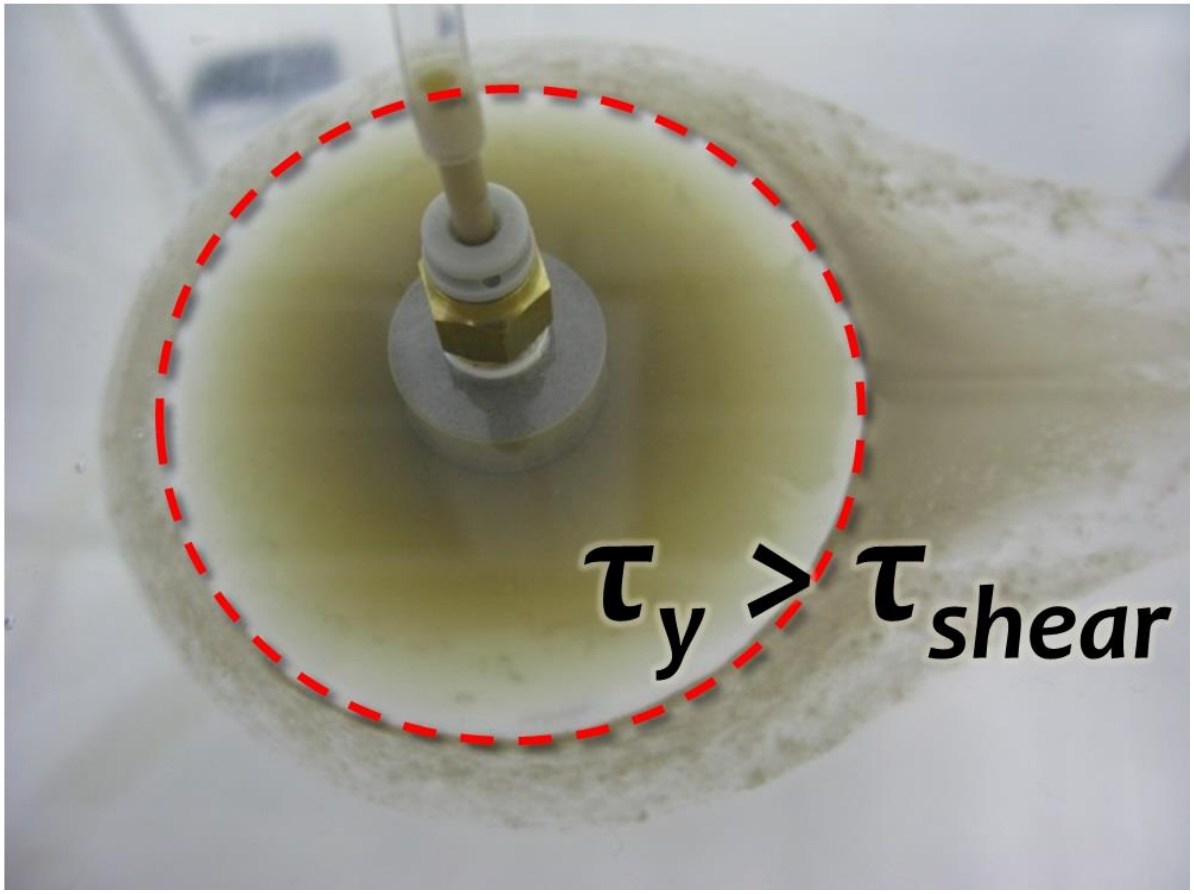
Eriksson & Schatz, Appl. Clay Sci. 108 (2015), 12.

Shear stress



Eriksson & Schatz, Appl. Clay Sci. 108 (2015), 12.

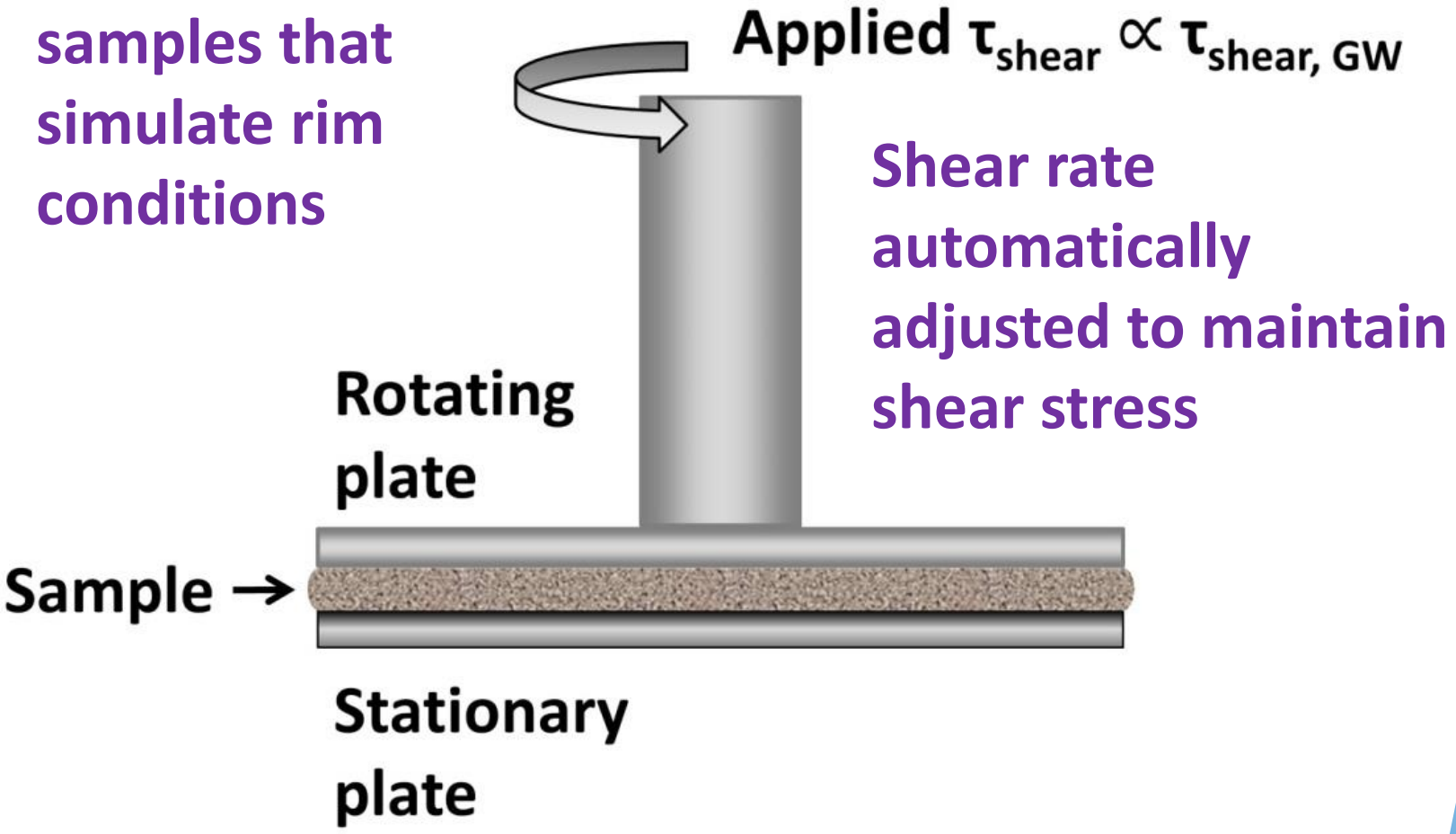
Shear stress



Effect of prolonged small shear stress?

Future experiment?

Prepare samples that simulate rim conditions



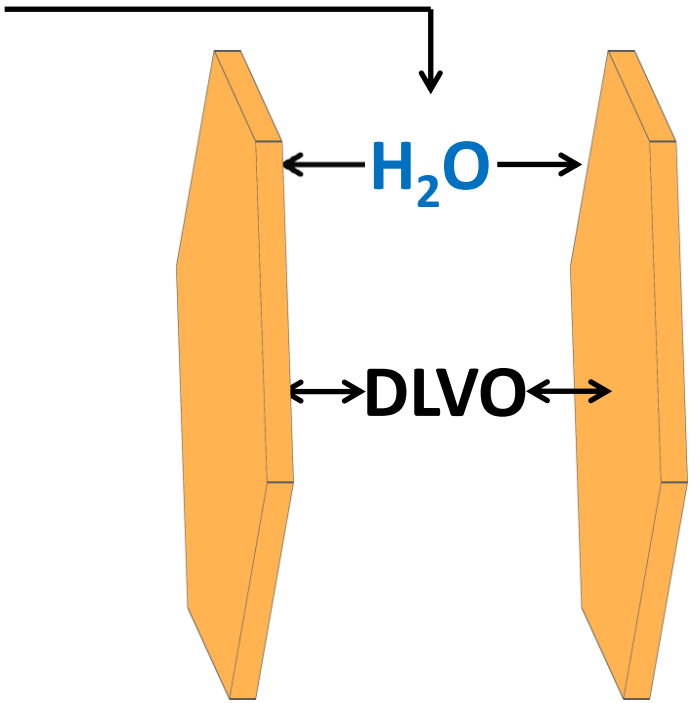
Could be utilized to study mechanical erosion (e.g. piping) on a wider scale

Swelling mechanism

Assumption: ***chemical forces induce detachment***

~~**Brownian motion**~~ **(too weak to overcome adhesion)**

Osmosis

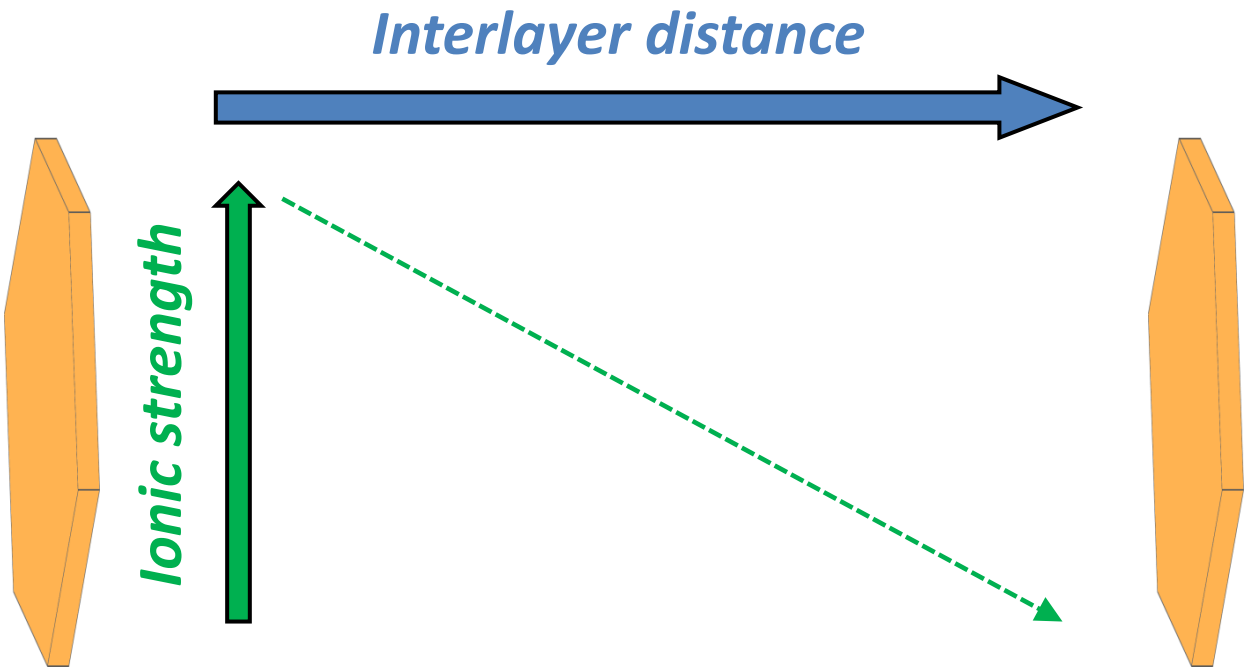


Swelling

Interaction energy as a function of interlayer distance:

- Assume constant number of (counter)-ions

- Ψ_0 = -100 mV, $A_H = 2 \cdot 10^{-20}$ J



Results

1 nm (3 M)	→	**Φ:** ***Negative (Attraction)*** **Slope:** ***Negative (strong repulsion)***
2 nm (1.5 M)	→	**Φ:** ***Negative (Attraction)*** **Slope:** ***Positive (Attraction)***
5 nm (0.6 M)	→	**Φ:** ***Negative (Attraction)*** **Slope:** ***Positive (Attraction)***
10 nm (0.3 M)	→	**Φ:** ***Negative (Attraction)*** **Slope:** ***Positive (Weak attraction)***
50 nm (0.06 M)	→	**Φ:** ***Negative (Attraction)*** **Slope:** ***Positive (Negligible attraction)***

Less than one kT

Conclusions

Particle detachment mechanism	Osmotic swelling (balance of forces: osmotic pressure / particle interactions / GW flow (velocity) / Brownian motion)
Groundwater chemistry / Clay – groundwater interactions	Increased ionic strength (of GW) → reduced osmotic driving force / flocculation due to compressed double layers Porewater composition largely depends on pore model (single vs. multi)
Groundwater velocity	Should have limited to no effect within expected range of velocities