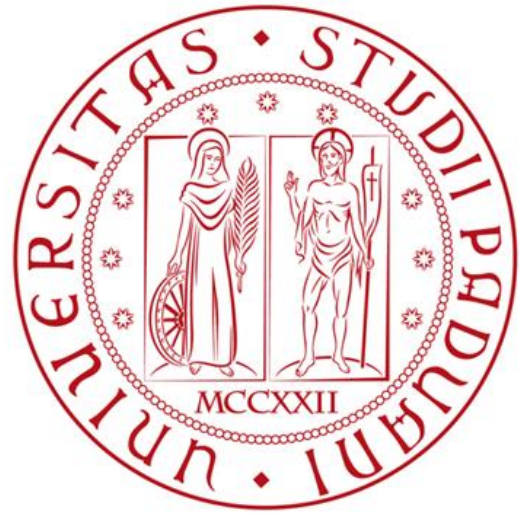


Friction behavior of gabbro under hydrothermal conditions



1222

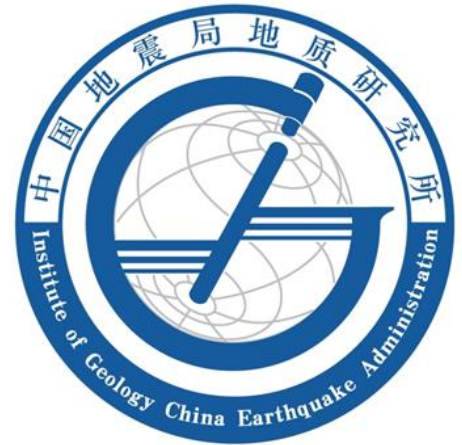
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2022.05.26 in Vienna



1951

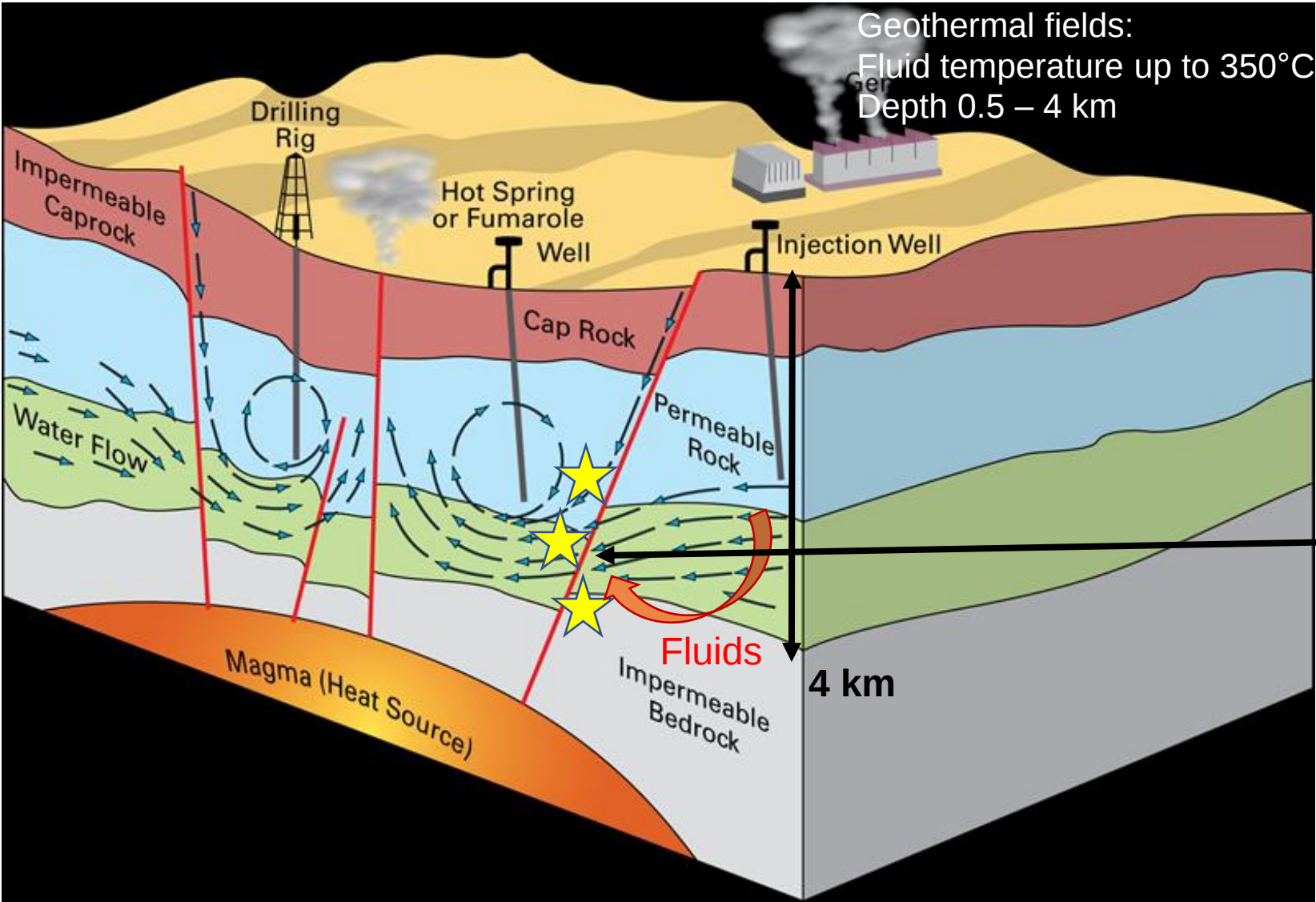
Contact: wei.feng@phd.unipd.it



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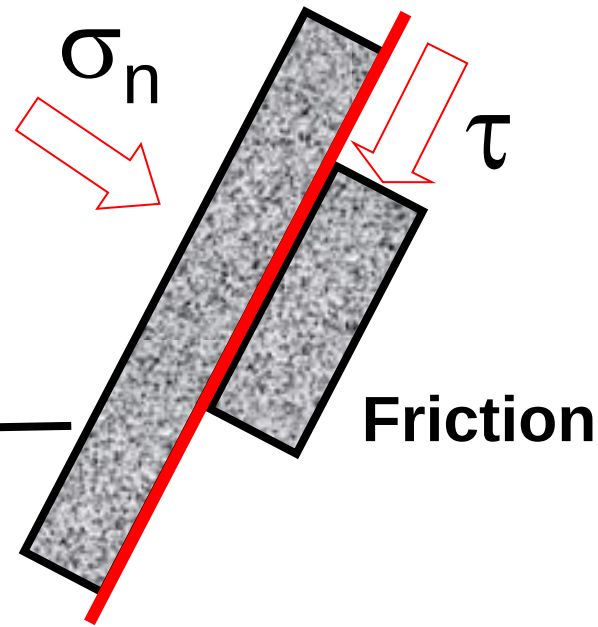
MOTIVATION



Geothermal fields: man-induced EQs

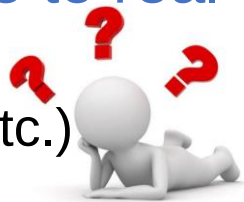
Friction coefficient

$$\mu = \tau / \sigma_n$$

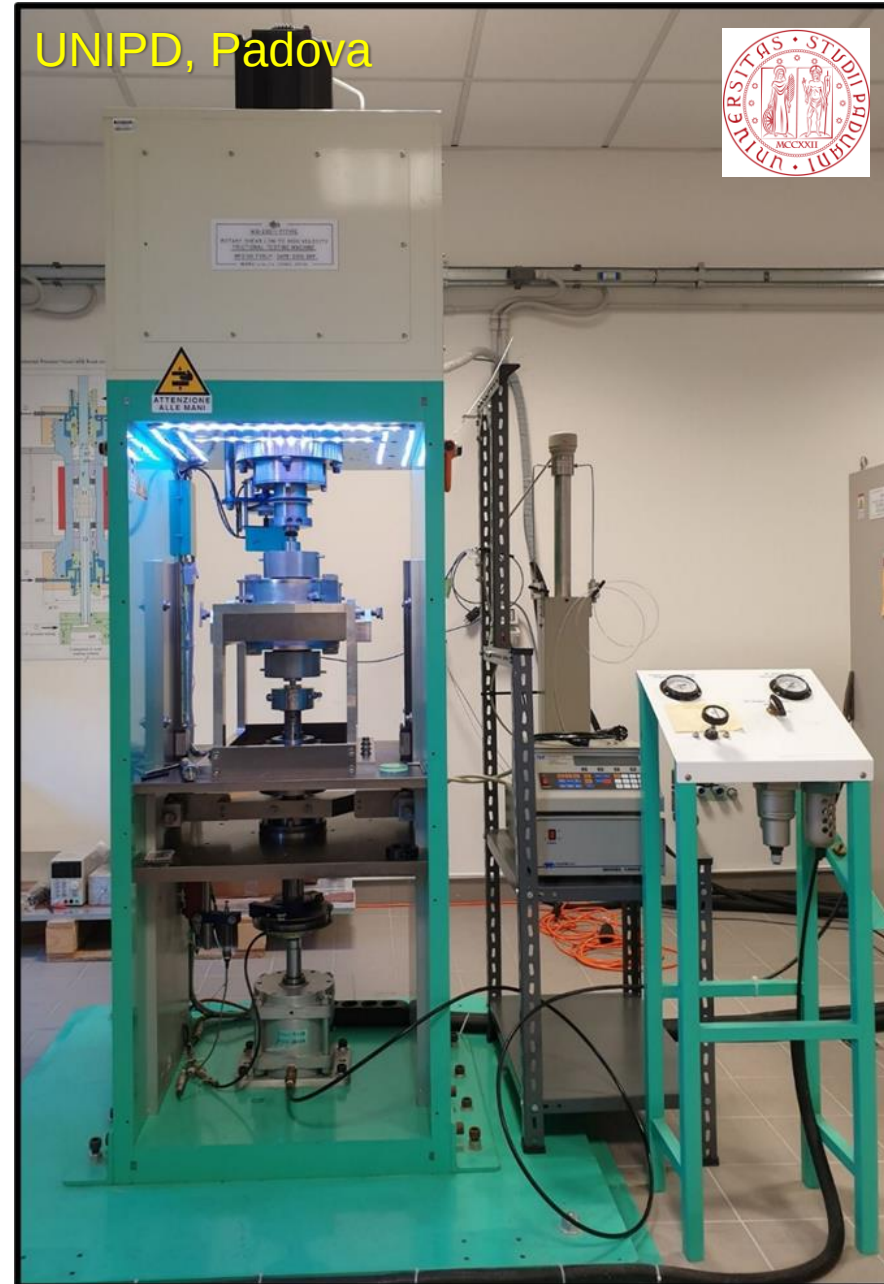


What are the frictional properties of faults under conditions comparable to real earthquakes?

(hydrothermal, long-slip, etc.)



METHODS Hydrothermal vessel & rotary Shear machine (designed by T. Shimamoto)

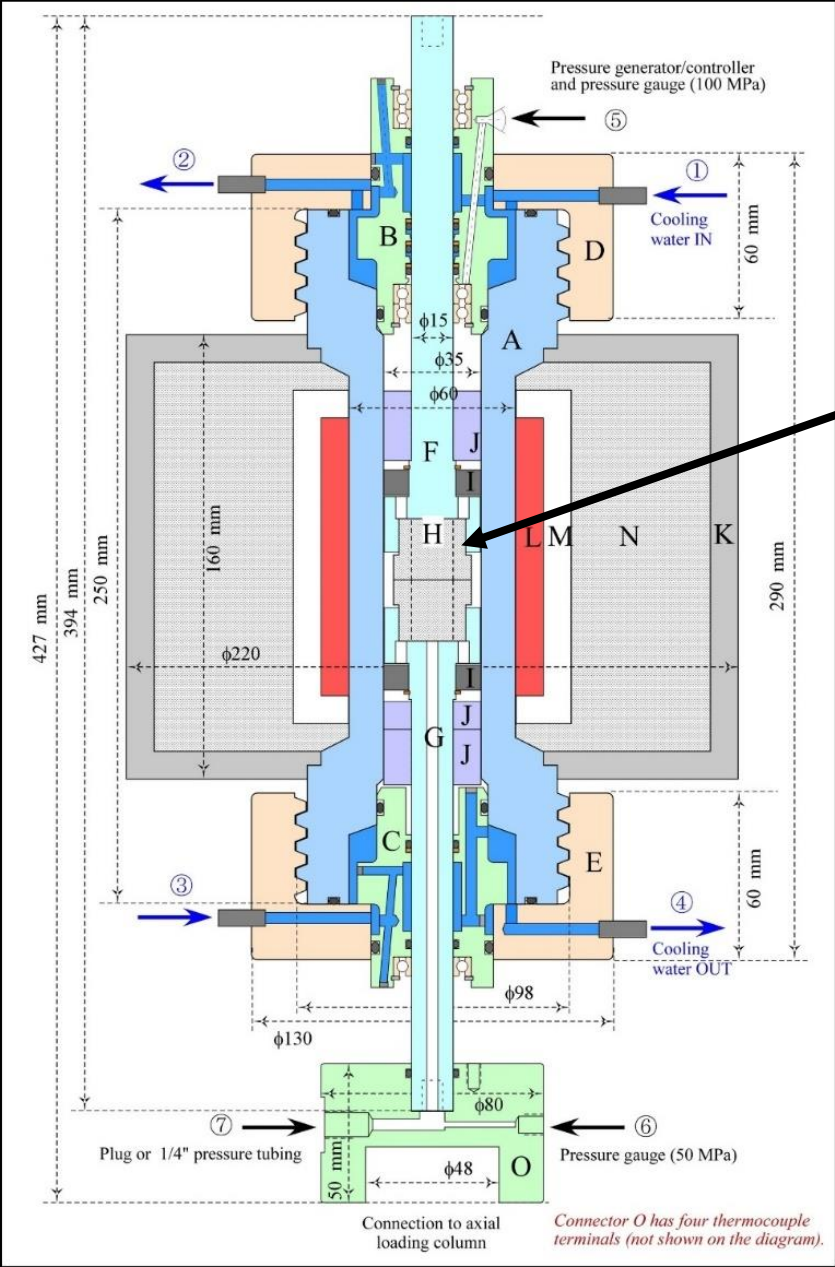


Capability/
Advantages:

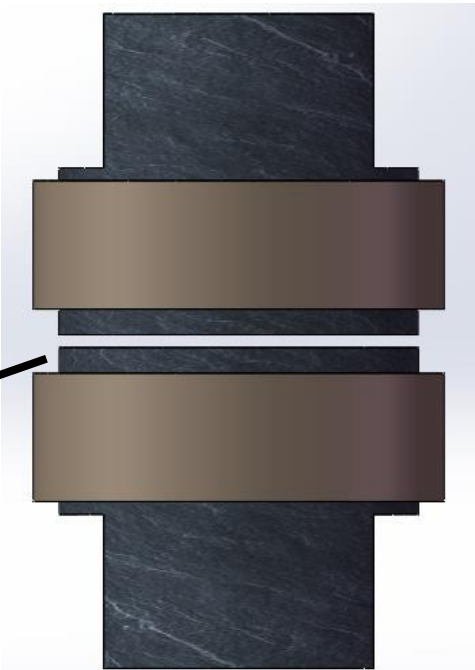
Slip rates:
nm/s to m/s

Slip: infinite

METHODS



Hydrothermal Vessel



Rock assembly

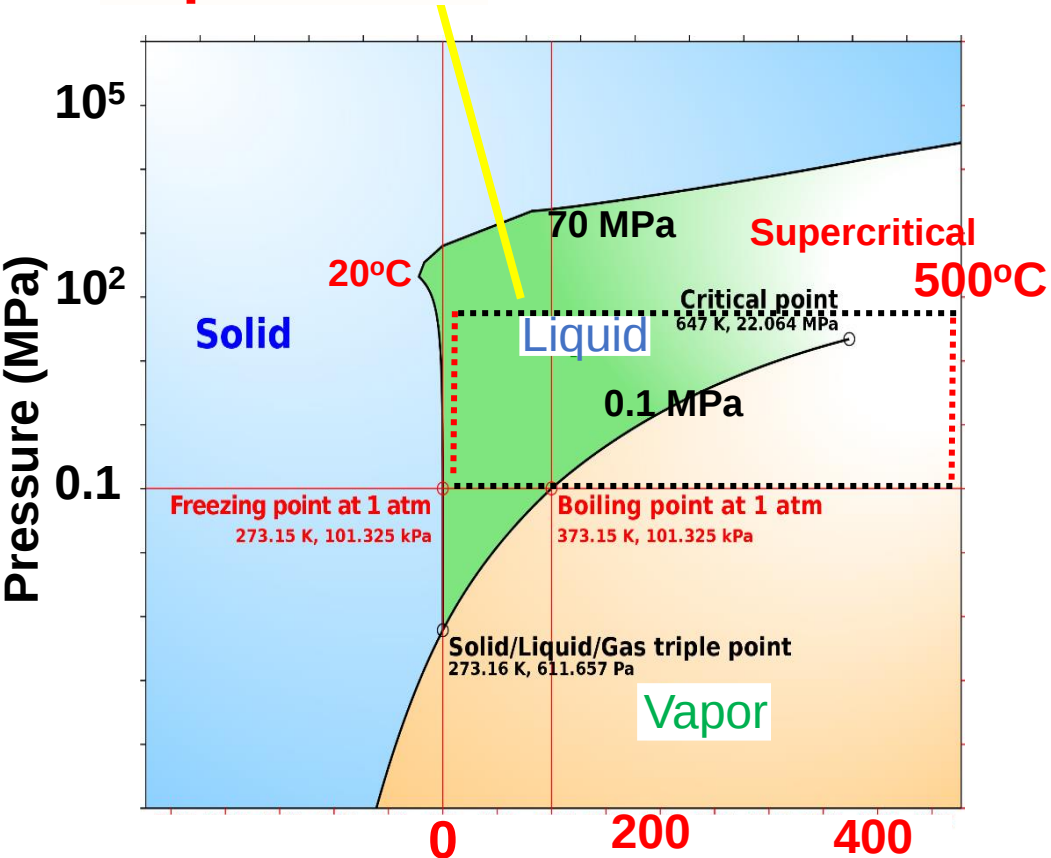


10 mm

Recovered sample

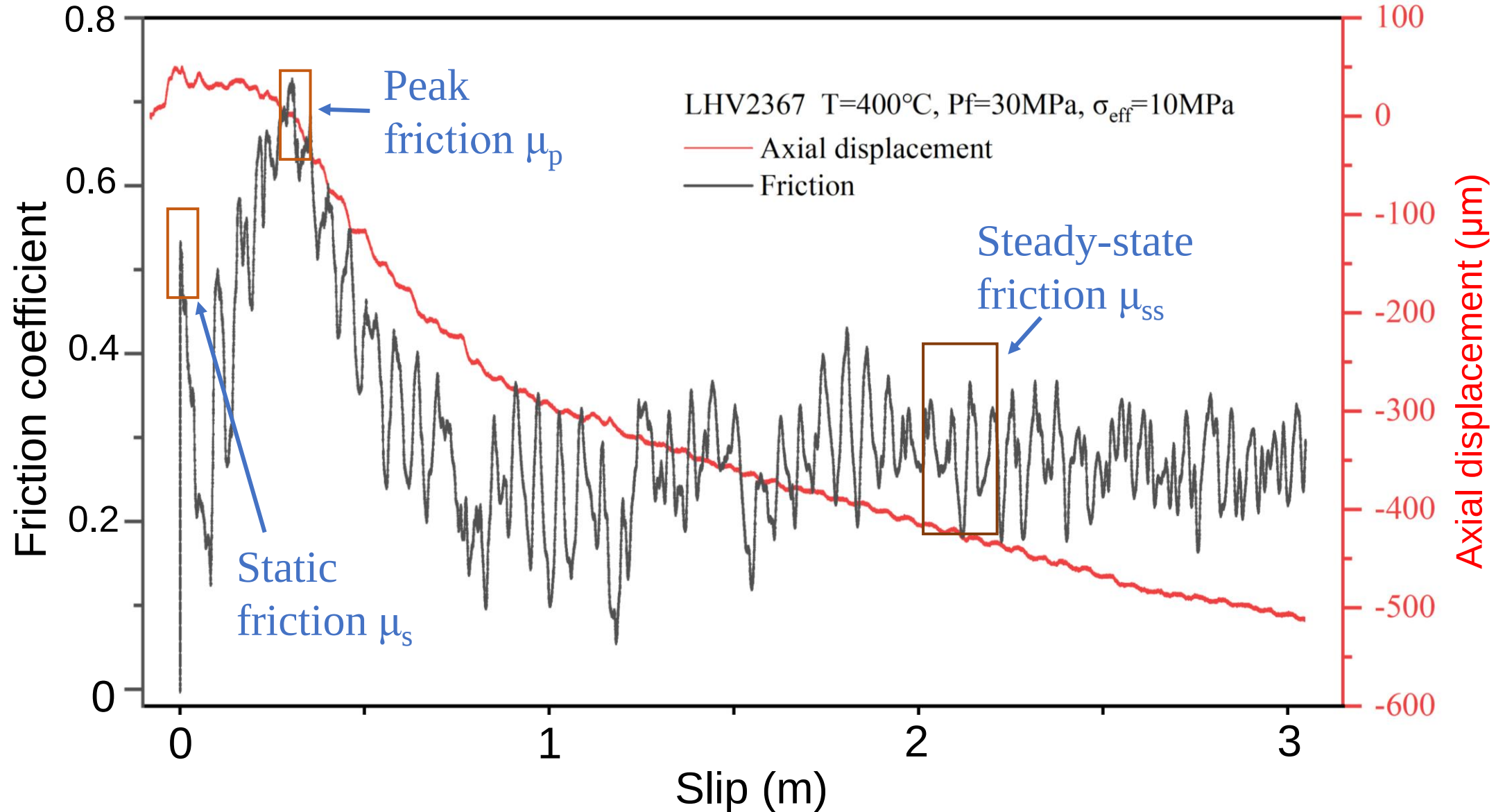
Experimental conditions:

- Vapor
- Liquid
- Supercritical



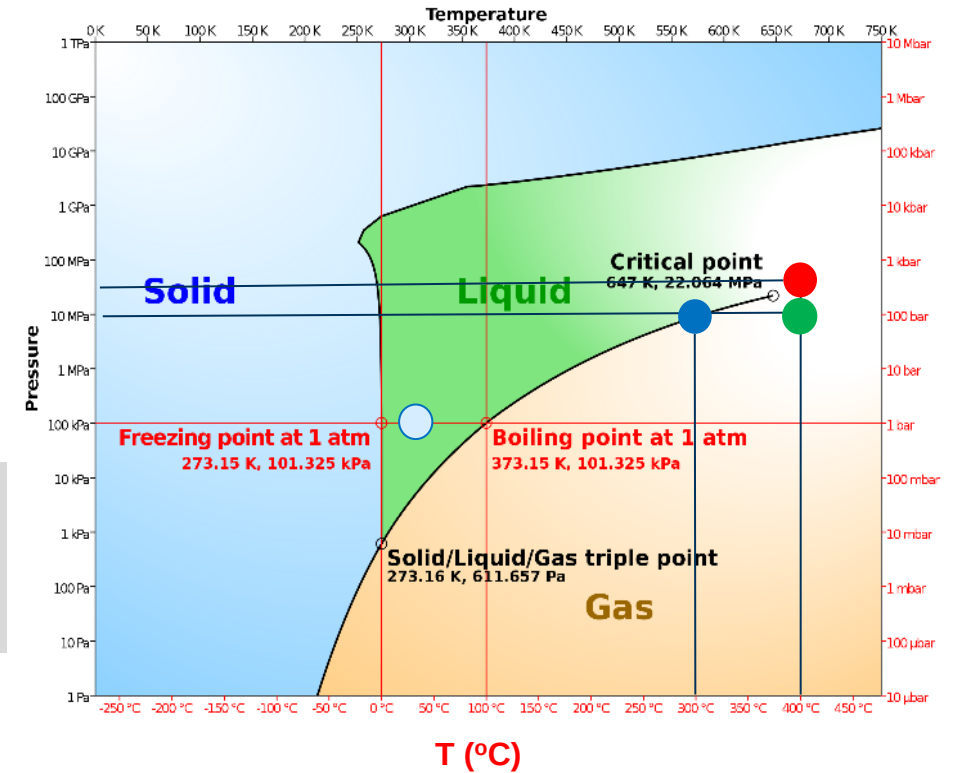
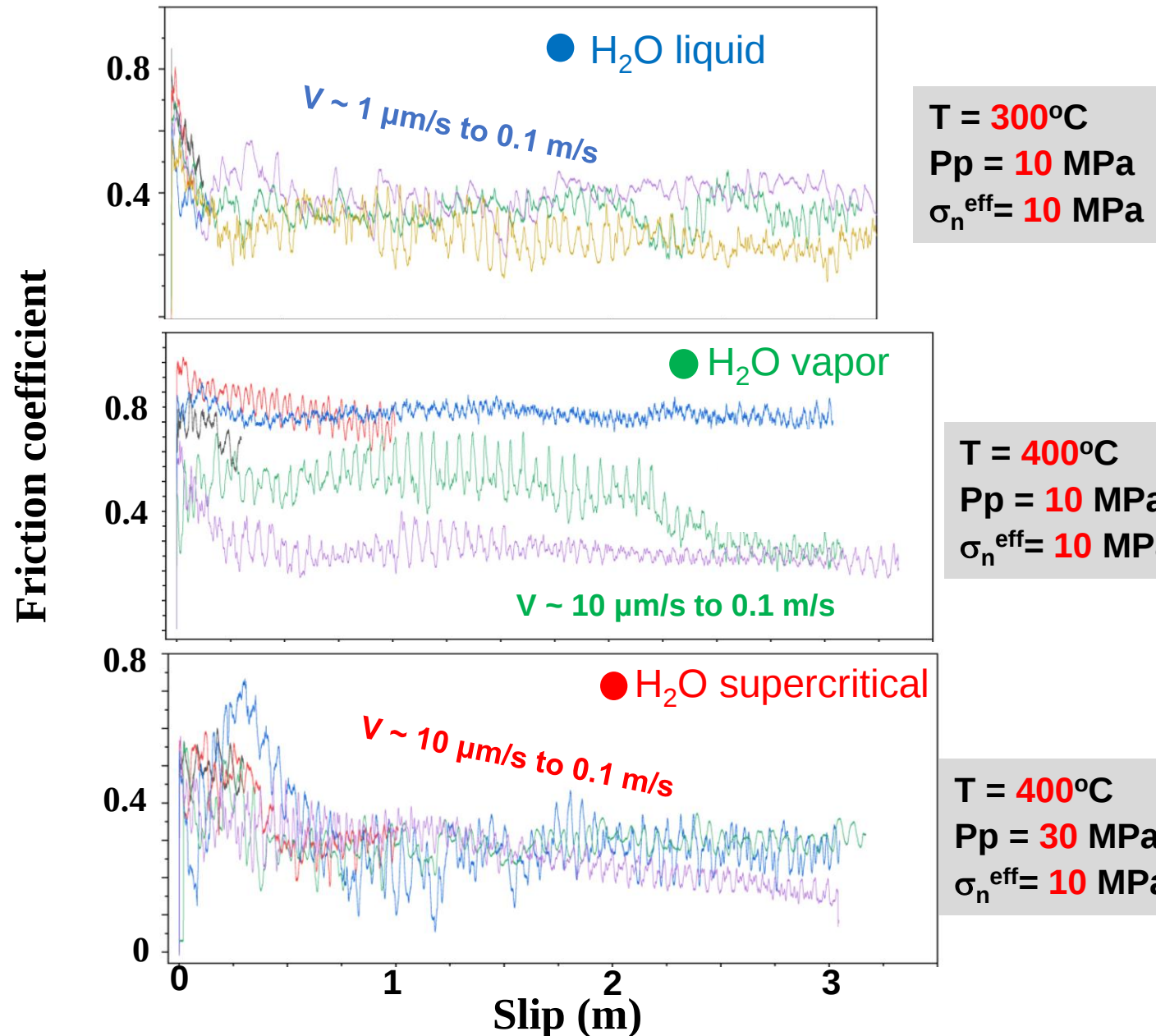
RESULTS

A representative experimental curve sheared at
 $T=400^{\circ}\text{C}$ & $P_p=30\text{ MPa}$, at $V=1\text{ mm/s}$



RESULTS

Gabbro sheared in pressurized & hot fluids at slip rates $1 \mu\text{m/s} < V < 0.1 \text{ m/s}$

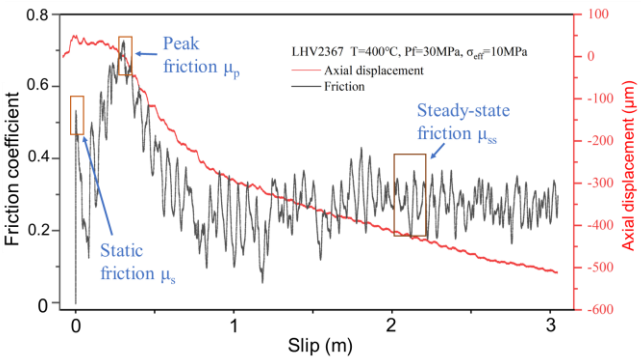
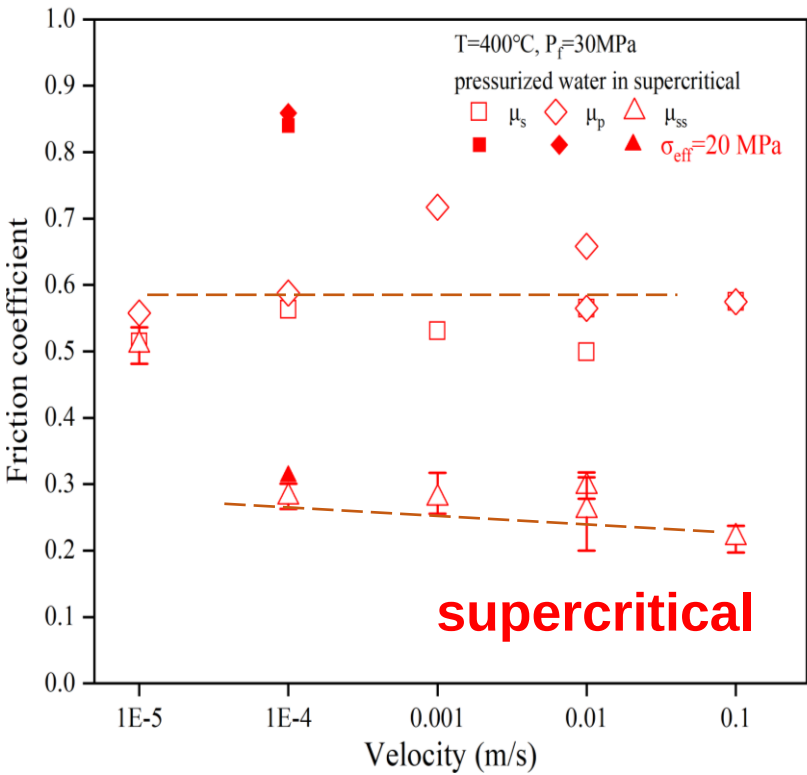
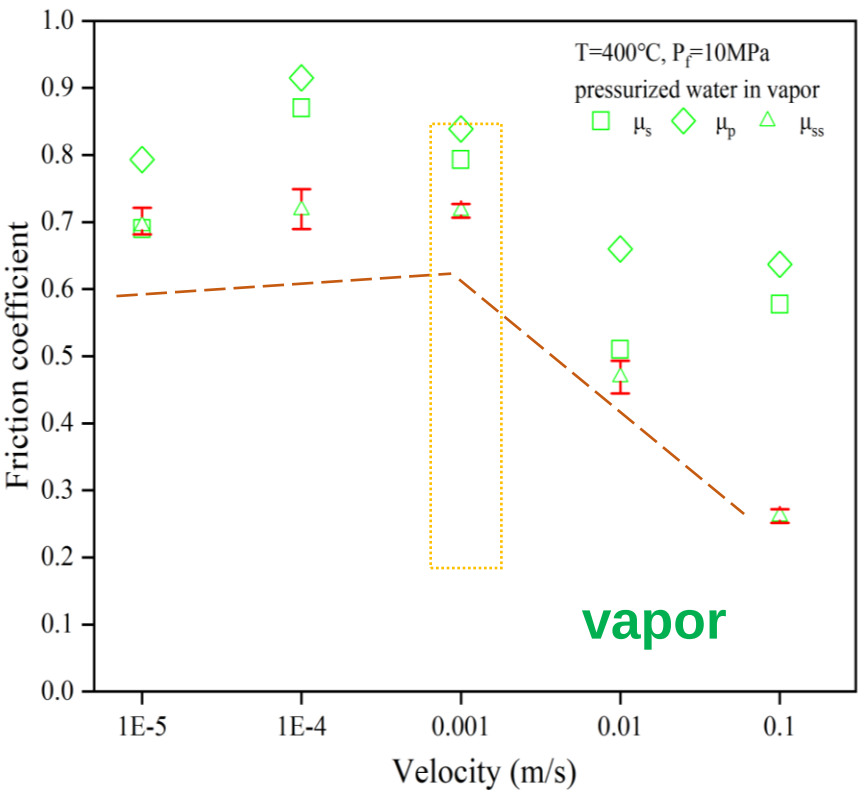
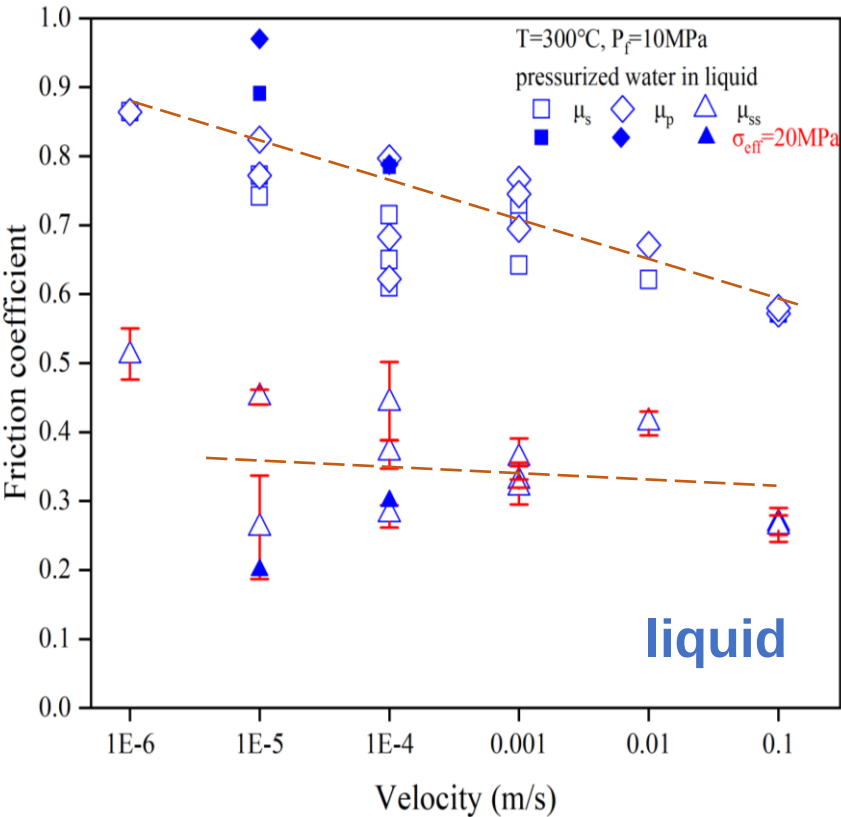


Vapor: weakening V -dependent

Liquid & supercritical: weakening at all V

RESULTS

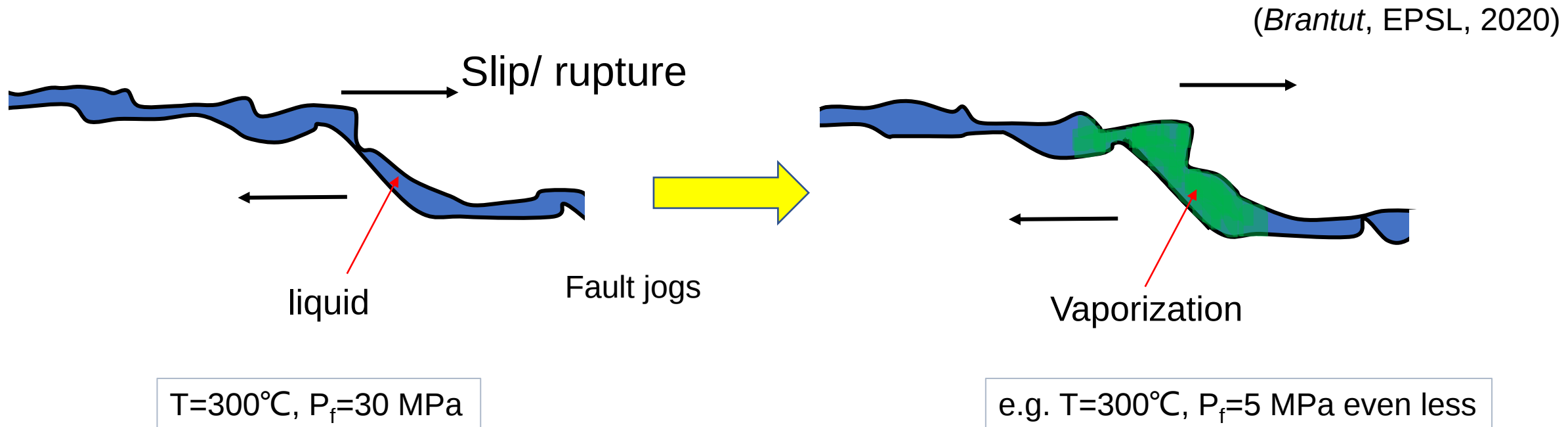
Static & peak & steady-state friction coefficient versus Slip rates



Take-home message

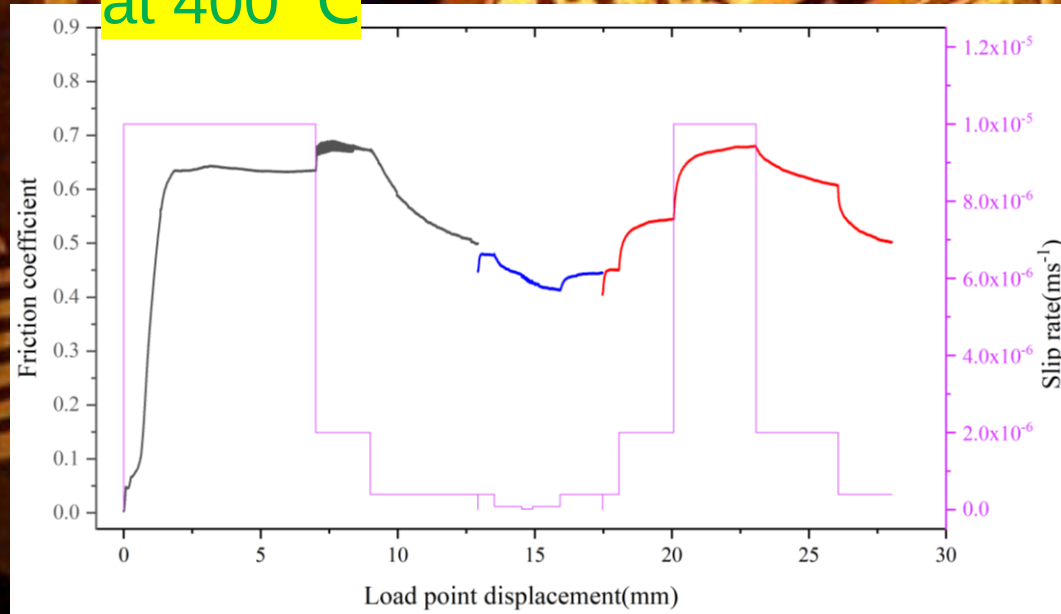
1) The fault friction could be quite low in the case of continuous fluid-driven slip in the geothermal field.

2) The physical state of pore fluid controls the friction coefficient —
Dilatancy-induced drop in pore pressure may arrest the fault slip and rupture.

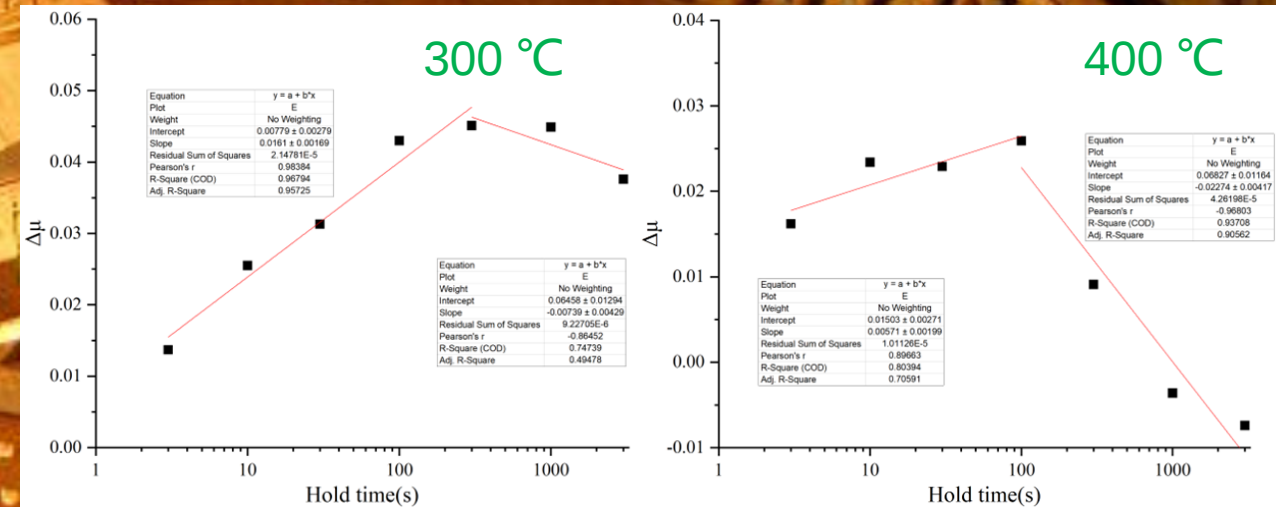


Thank you for your attention!!!

Brittle-ductile transition on Basalt at 400 °C



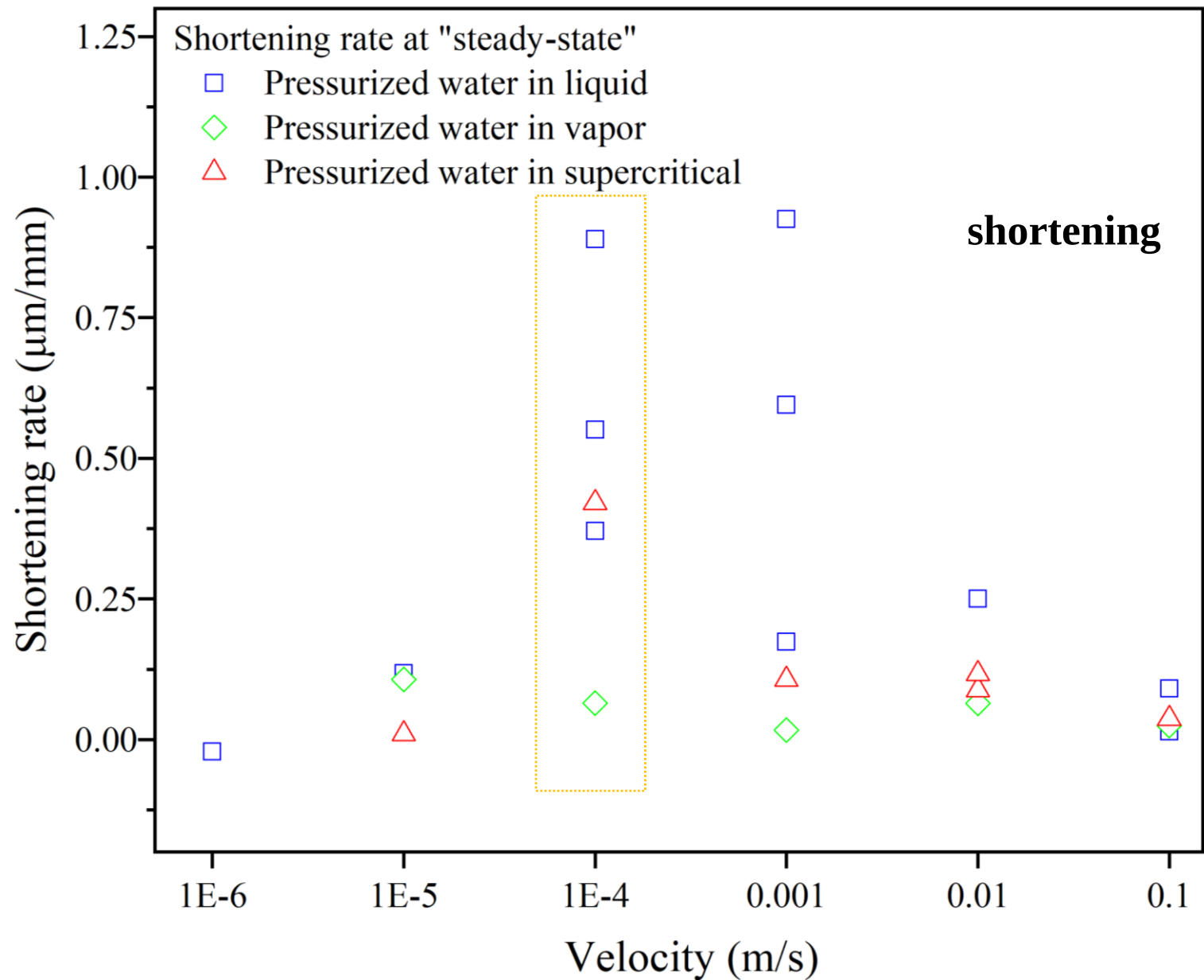
Negative healing rate on gabbro



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RESULTS

Shortening rates versus Velocity under hydrothermal conditions



The effect of normal stress on slip weakening

Gabbro

