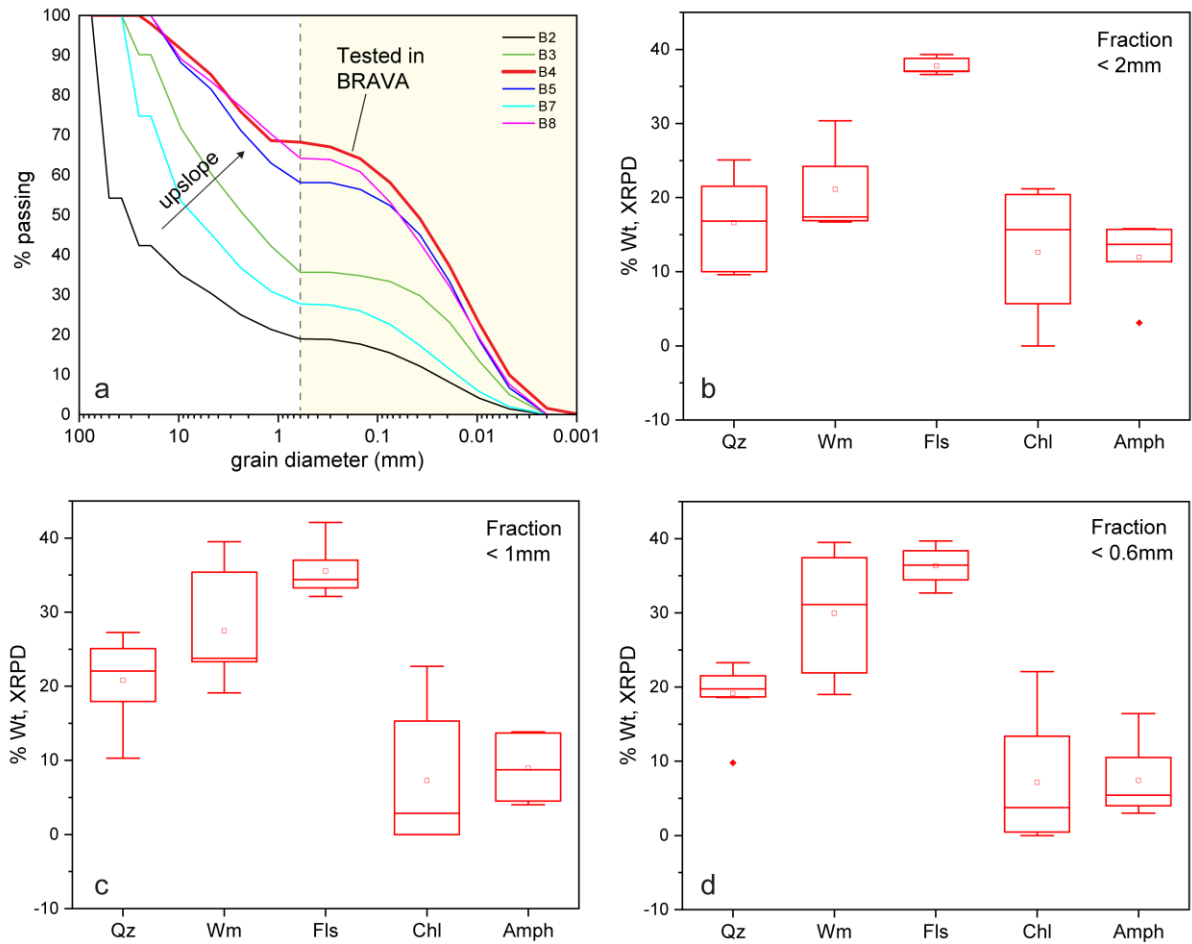


Slow-to-fast transition of giant creeping rockslides modulated by undrained loading in basal shear zones

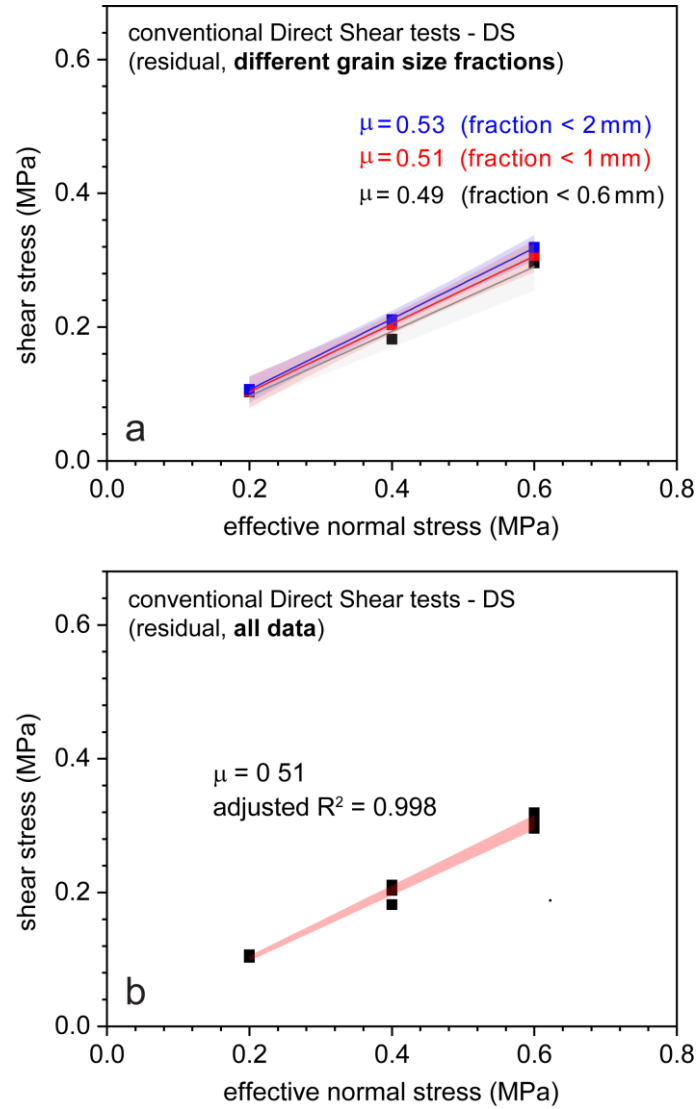
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Supplementary Information



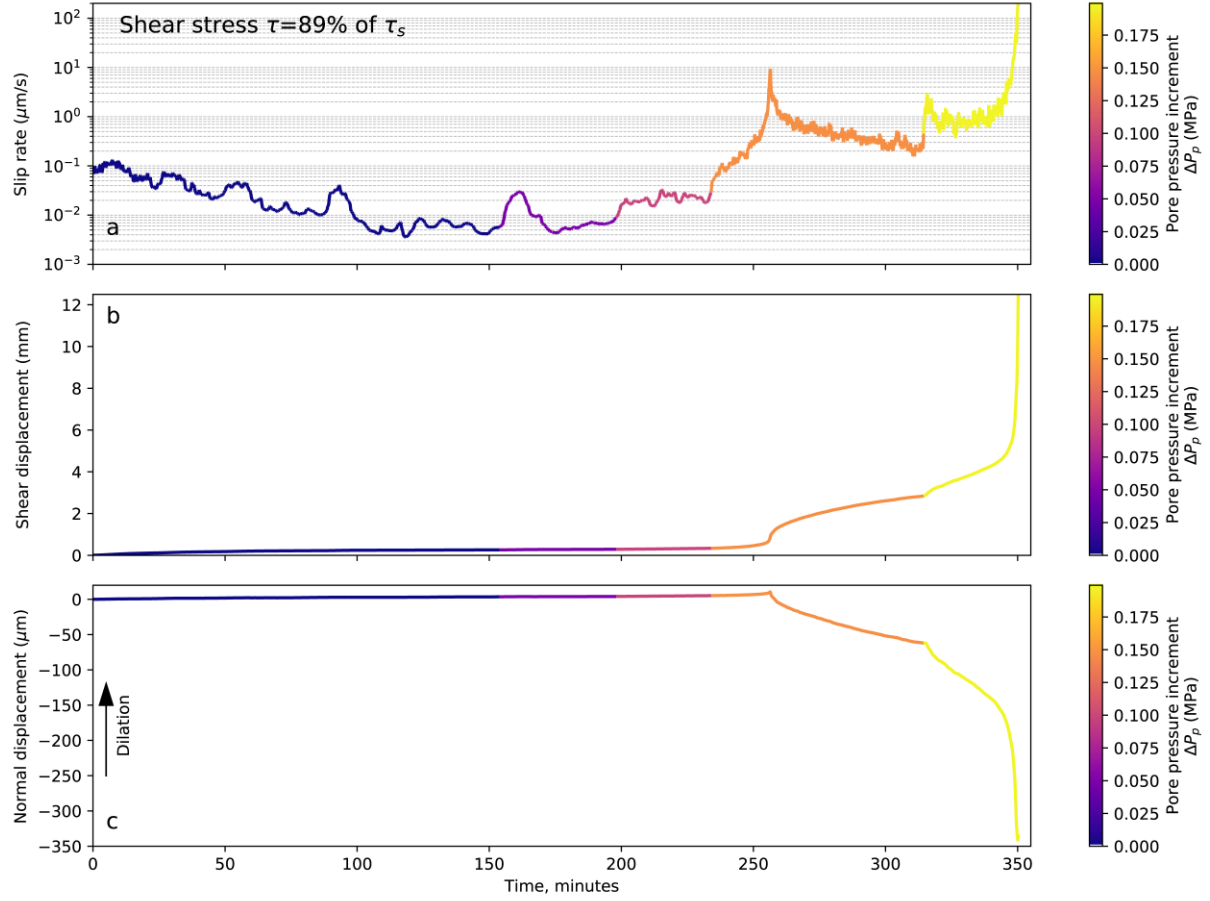
Supplementary Figure 1. Grain size and mineral compositions.

(a) Grain size distributions of cataclastic shear zone samples collected from the basal shear zone of the Spriana rockslide (locations in Fig. 1b). The yellow shade indicated the grain size fraction subjected to laboratory experiments; **(b,c,d)** mineral composition distributions (XRPD) of different gouge grain size fractions, showing the weak dependence of mineral composition on the choice of the grain size fraction subjected to laboratory experiments. Box plot elements: center line, median; square, mean; box limits, upper and lower quartiles; whiskers, 1.5x interquartile range; points, outliers.



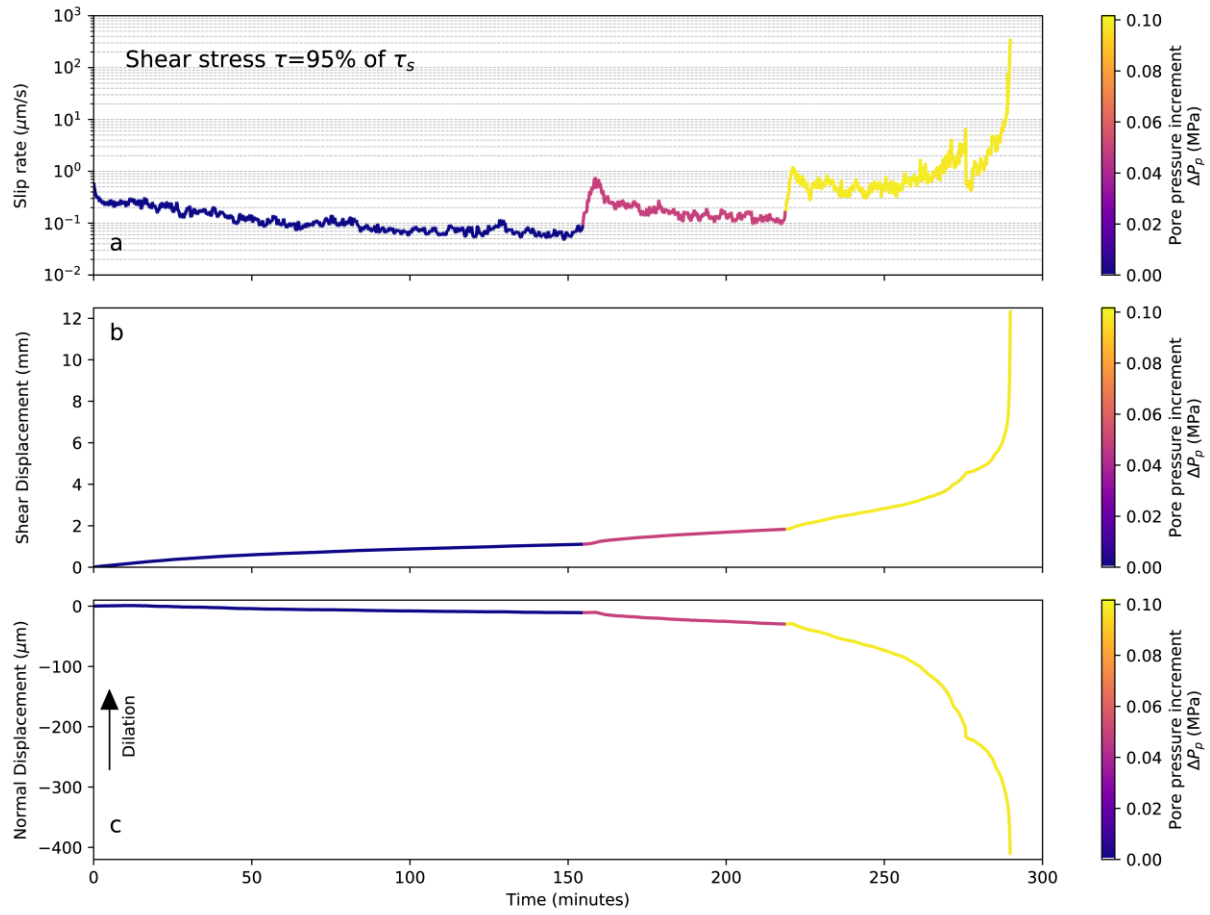
Supplementary Figure 2. Mohr-Coulomb envelopes.

Mohr Coulomb failure envelopes obtained on different gouge grain size fractions by conventional geotechnical direct shear tests, showing the weak dependence of frictional strength on the choice of the grain size fraction subjected to lab experiments: **(a)** envelopes obtained for individual grain size fractions; **(b)** envelope fit for the entire dataset. Shaded areas are 95% confidence bands of linear fit.



Supplementary Figure 3. Shear zone evolution during laboratory pore pressure-step creep experiment ($\tau=0.89 \tau_s$).

Experimental time series of **(a)** slip (shear displacement) rate; **(b)** cumulative shear displacement; **(c)** normal displacement (positive value: dilation).



Supplementary Figure 4. Shear zone evolution during laboratory pore pressure-step creep experiment ($\tau=0.95 \tau_s$).

Experimental time series of **(a)** slip (shear displacement) rate; **(b)** cumulative shear displacement; **(c)** normal displacement (positive value: dilation).

Acceleration period	Total Duration (days)	Time to peak velocity (TV _P , days)	Peak velocity (V _P , μm/s)	Long-term velocity (V _{CH} , μm/s)
1	32	3	0.067	0.003
2	35	3	0.0185	0.002
3	60	2	0.022	0.0017
4	47	5	0.031	0.0015
5	47	6	0.012	0.0025
6	18	5	0.012	0.0023
7	150	15	0.013	0.004
8	79	11	0.023	0.004

Supplementary Table 1. Characteristics of selected rockslide acceleration periods (Fig. 1).

Variables	Dataset	# data	Spearman ρ	p-value	Perason r	p-value
TV _P – ΔP _f (Fig. 5b)	Lab: τ _{mob} = 0.86	3	-0.5	0.67	-	-
	Lab: τ _{mob} = 0.89	4	-1	-	-0.93	0.07
	Lab: τ _{mob} = 0.95	2	-	-	-	-
	Rockslide	8	-0.53	0.17	-	-
V _P – ΔP _f (Fig. 5c)	Lab: τ _{mob} = 0.86	3	1	-	0.997	0.046
	Lab: τ _{mob} = 0.89	4	0.8	0.2	-	-
	Lab: τ _{mob} = 0.95	2	-	-	-	-
	Rockslide	8	0.13	0.75	-	-
V _{CH} – ΔP _f (Fig. 5d)	Lab: τ _{mob} = 0.86	3	1	-	0.928	0.24
	Lab: τ _{mob} = 0.89	4	1	-	0.912	0.08
	Lab: τ _{mob} = 0.95	2	-	-	-	-
	Rockslide	8	0.92	0.001	0.9	0.002

Supplementary Table 2. Correlation statistics for laboratory and rockslide data in Fig. 5.