Table 2. List of Experiments and Conditions

Experiment	σ_n (MPa)	V (m/s)	a (m/s^2)	d (m)	μ_{ss}	Notes
s042	40	6.5	65	14.93	0.052	deceleration 7.2; no grinding
s049	20	3	30	6	0.110	
s050	20	3	30	6	0.105	
s051	20	3	6	6	0.106	
s052	20	3	3	6	0.120	
s053	20	3	3	6	0.105	
s054	20	3	6	6	0.111	
s056	20	3	15	6	0.112	
s058	20	3	15	7.81	0.101	
s059	20	3	15	6	0.103	
s062	40	3	30	6	0.075	
s063	40	3	3	6	0.073	
s064	10	3	30	6	0.147	
s065	10	3	3	6	0.175	
s066	20	5	30	6	0.103	
s067	20	6.5	30	6	0.109	
s070	20	1	30	~4	0.112	reached end of axial stroke
s071	15.5	1.14	2.85	15.21	0.145	
s072	1.4	10^{-3}–0.8	5	68.20	0.662	
s073	5	10^{-3}–3	30	6	0.258	
s074	10	3	30	6	0.145	
s079	15	3	30	6	0.126	
s082	20	3	60	6	0.106	
s088	20	3	2	6	0.105	
s097	30	3	30	6	0.089	
s106	5	3	30	6	0.265	
s107	30	3	3	6	0.092	
s111	2.5	3	30	14.56	0.358	
s113	7.5	3	30	9.14	0.195	
s114	50	3	30	0.45	0.071	40/50; sample failed
s115	1	3	30	22.08	0.556	
s117	0.7	3–0.3	30	35.43	0.494	
s129	10	1.3	3.25	10.08	0.098	solid 50 mm

[15] Normal stress initially decreases by up to 5% (note the change in scale in the normal stress axis), indicating that the air-actuated system is not able to keep up with the fast shortening of the sample (either because the response time of the electrovalve that controls the pressure is too long or because the friction of the seal inside the actuator prevents fast movement). However, the drop in normal stress is relatively small and we use the measured instantaneous normal stress in all our calculations of the friction coefficient, so it does not affect the results. Also, we can see in Figure 5b that the imposed slip velocity displays a small overshoot (less than 5%) in the acceleration. Since we are mostly interested in the steady state portion of the experiment in this contribution, we do not consider these to be of importance (and the overshoots are very short-lived in comparison to the duration of the experiment).

[16] Shear stress increases abruptly upon initial sliding, reaching a first peak (after ~10 ms in the specific case of experiment s049; see point a in Figure 5a), followed by an abrupt drop (point b) and then a more gradual increase reaching a broad maximum/peak (point c), after which shear stress decays (transient stage) toward a steady state value after ~500 ms (~1 m of slip; see point d). Note that the timing of the peaks described in the example of Figure 5a are not general but strongly depend on the experimental conditions applied. Shear stress remains constant during the remainder of the experiment until the sliding velocity decreases and shear stress increases (point e), reaching a maximum at the end of the experiment (point f). This sequence of first weakening (points a to b), strengthening (points b to c) and second weakening (points c to d) toward steady state shear stress is similar to the one described in similar rocks (India gabbro) by *Tsutsumi and Shimamoto* [1997] and *Hirose and Shimamoto* [2005a]. The measured axial displacement is virtually zero during the initial part of the experiment, but when the shear stress decays after the (second) broad maximum, the sample shortens at a roughly constant rate, consistent with observation of full-scale melt production and extrusion. Note that Figure 5 displays one out of every 25 data points (i.e., decimated data) to facilitate synchronization with the data acquired from the motor (which was recorded at 1 kHz) but the data are not filtered. As a result, we can observe oscillations in the shear stress and shortening. Though very stiff compared to other rotary shear apparatuses (the measured stiffness is 1.63 Nm/μm in rotation and 0.22 kN/μm in the axial direction), SHIVA is not infinitely stiff and vibrates when excited under the extreme deformation conditions imposed in the experiments. Vibrations are induced by (1) the energy input from the motor (in some experiments, the sample accelerates from 0 to 3000 rpm in 0.1 s, which is almost like hammering the sample) and (2) slight sample misalignment. The vibrations with the largest amplitude occur at a frequency of about 200 Hz. Detailed analysis of the typical frequencies of SHIVA by means of (1) FEM modeling and (2) accelerometers located in several parts of the apparatus have shown that 200 Hz is the characteristic frequency of the apparatus and especially of the stationary loading column and the torque bar. Therefore, in the following we show data that have been averaged over 250 records (similar to applying a filter at a frequency of 100 Hz) to reduce the