

Syn-convergence flow inside and at the margin of orogenic plateaus: Lithospheric-scale experimental approach

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Introduction

The provided auxiliary material is of three types:

- systematic presentations of the results for each experiment (Figure S1 for experiment C2, S2 for C4, S3 for C5, S4 for C6, S5 for C7, S6 for C8)
- top view photos of the experiments (Figure S7 for experiments C1 to C4, S8 for experiments C5 to C8, S9 for experiments F1 to F3)
- tables of finite strain data for experiments with lateral escape (S10 for experiment F2 and S11 for F3)
- tables of extrusion data for experiments with lateral escape (S12 for experiment F1, S13 for F2, S14 for F3).

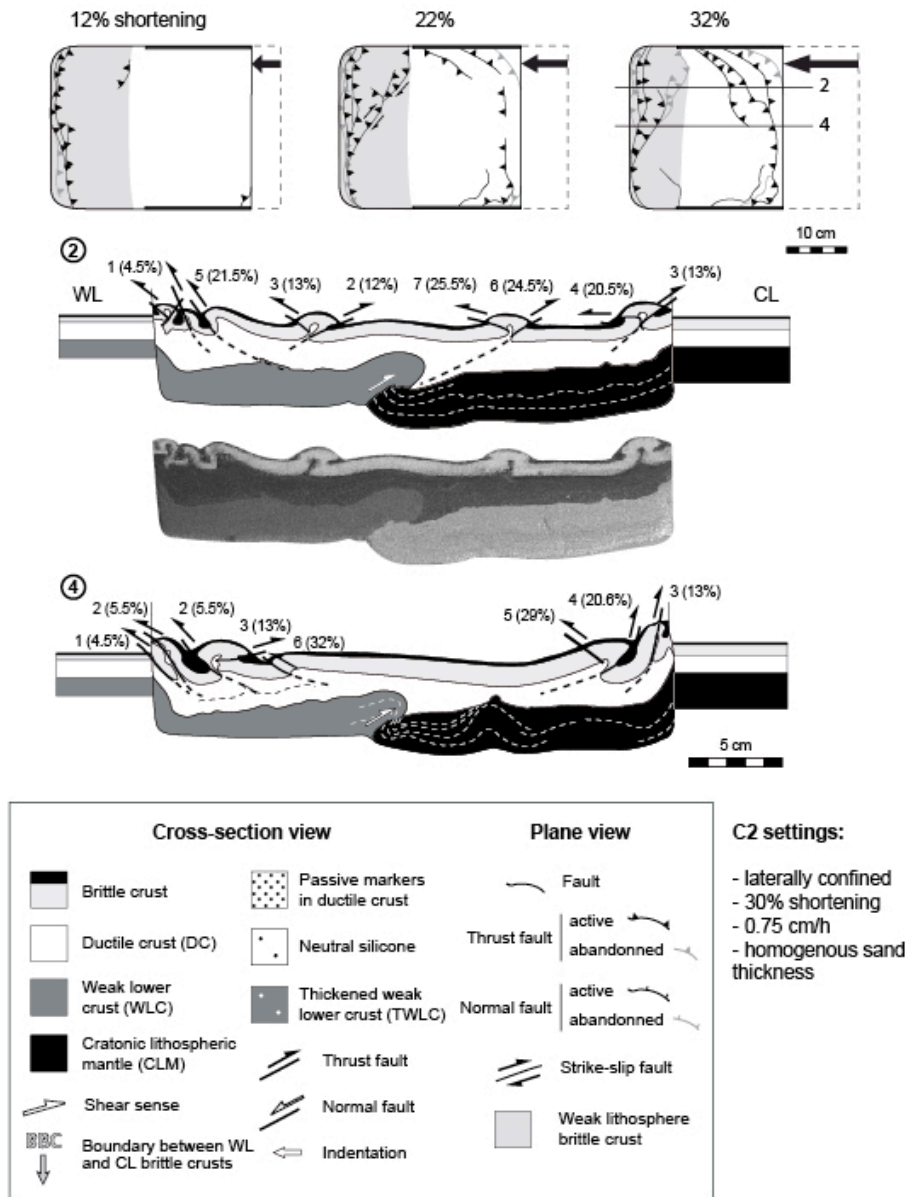


Figure S1. Results of experiment C2 with three interpreted top views in the upper panel, and two typical cross-sections including a photo in the lower panel.

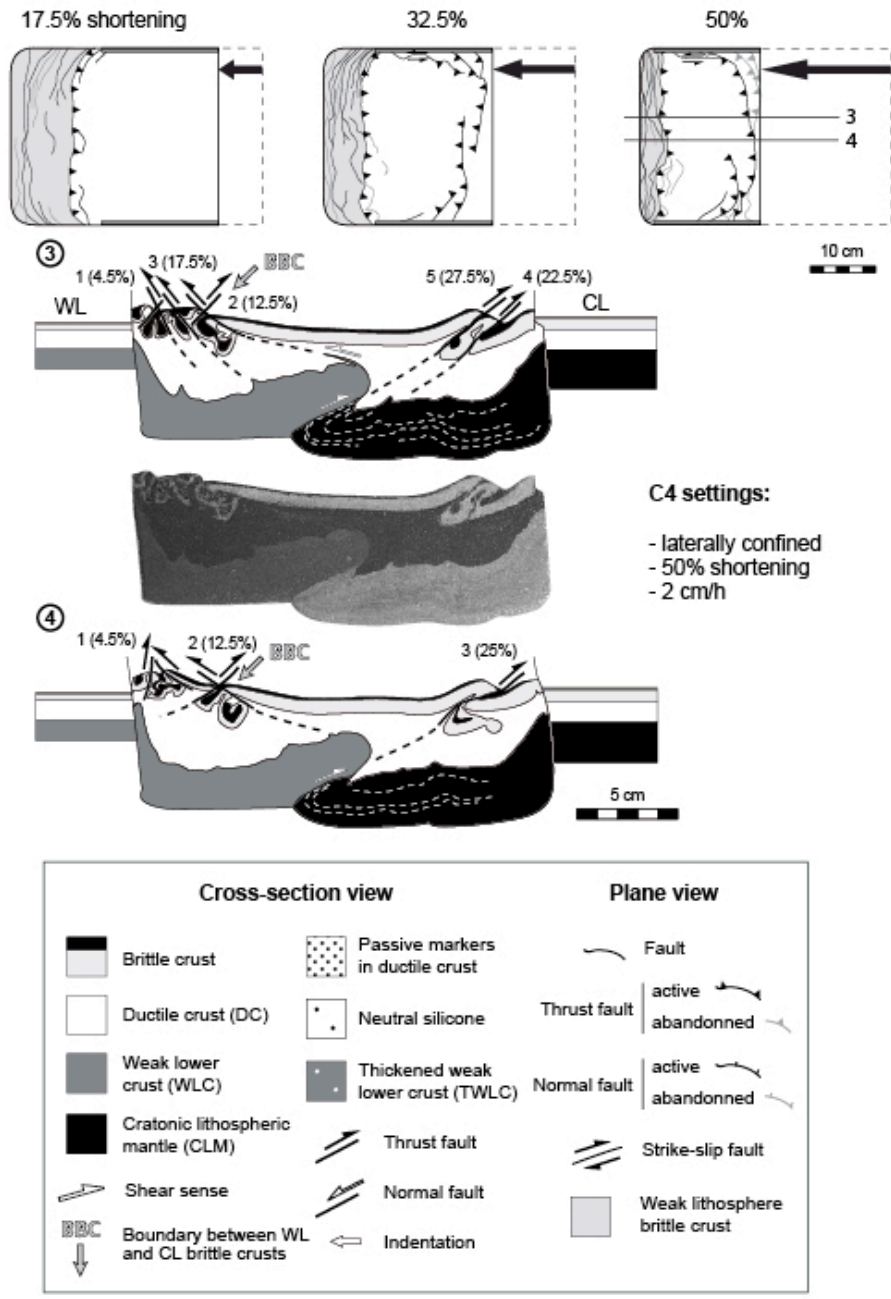


Figure S2. Results of experiment C4 illustrated by three interpreted top views in the upper panel, and two typical cross-sections including a photo in the lower panel.

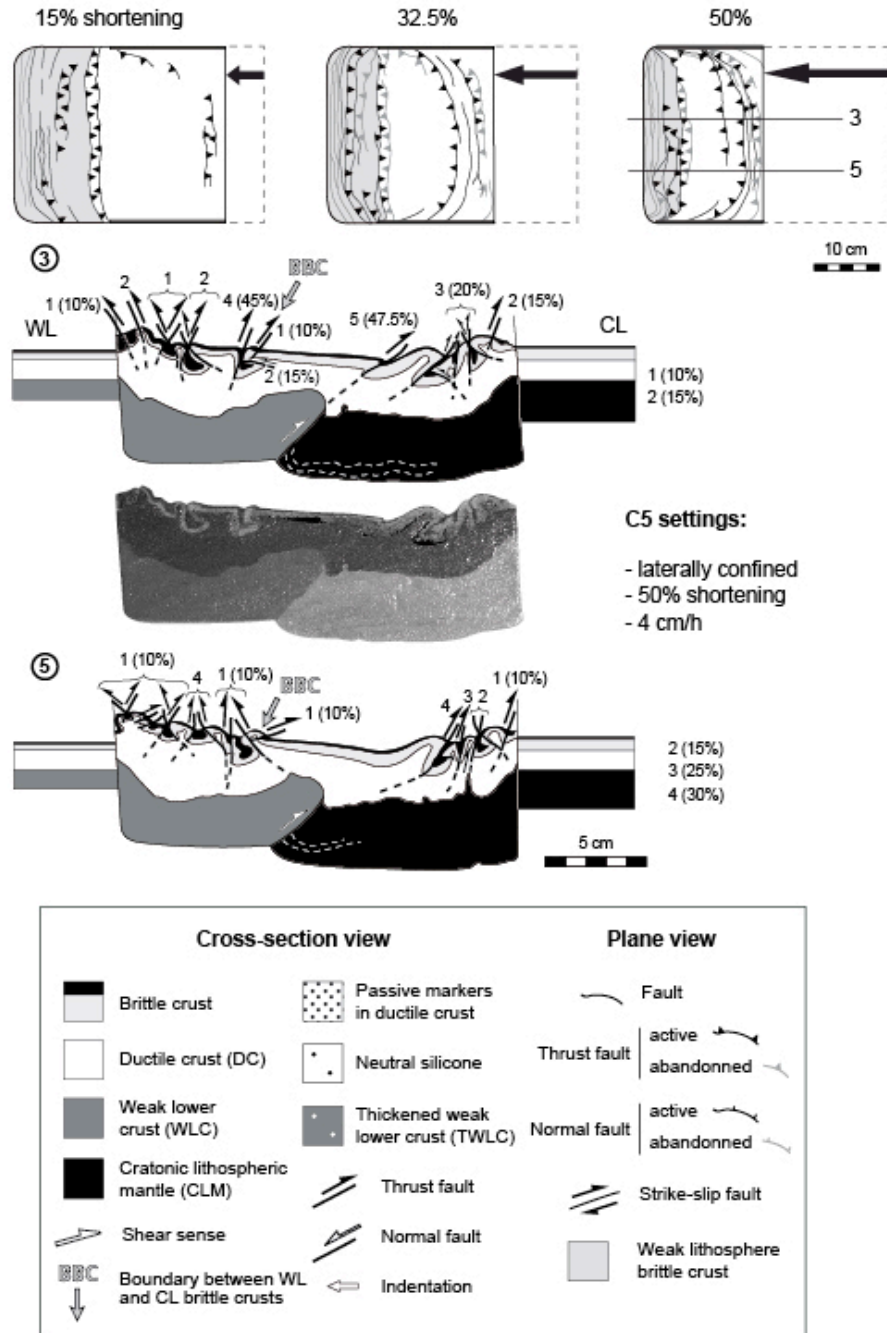


Figure S3. Results of experiment C5 illustrated by three interpreted top views in the upper panel, and two typical cross-sections including a photo in the lower panel.

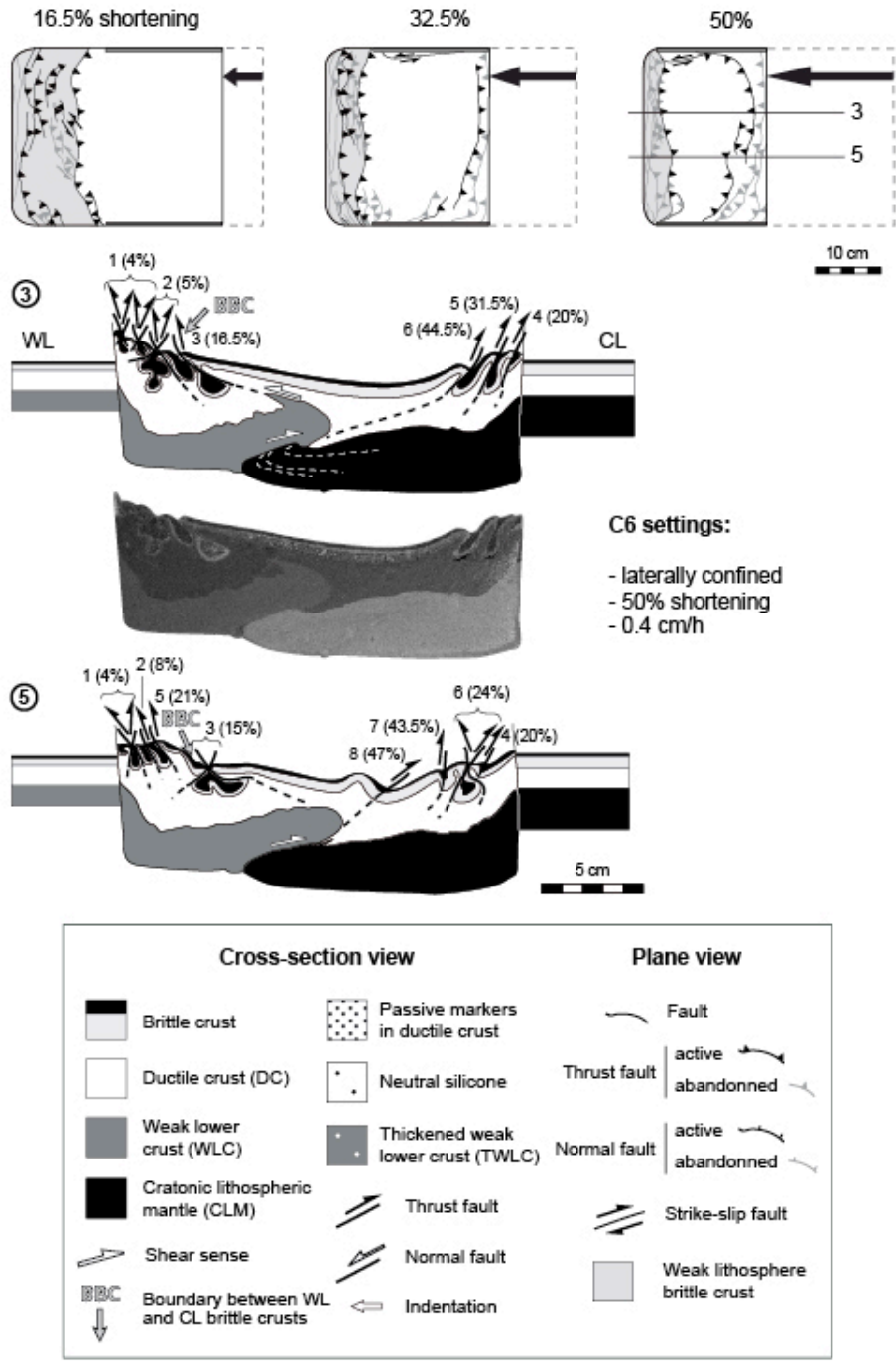


Figure S4. Results of experiment C6 illustrated by three interpreted top views in the upper panel, and two typical cross-sections including a photo in the lower panel.

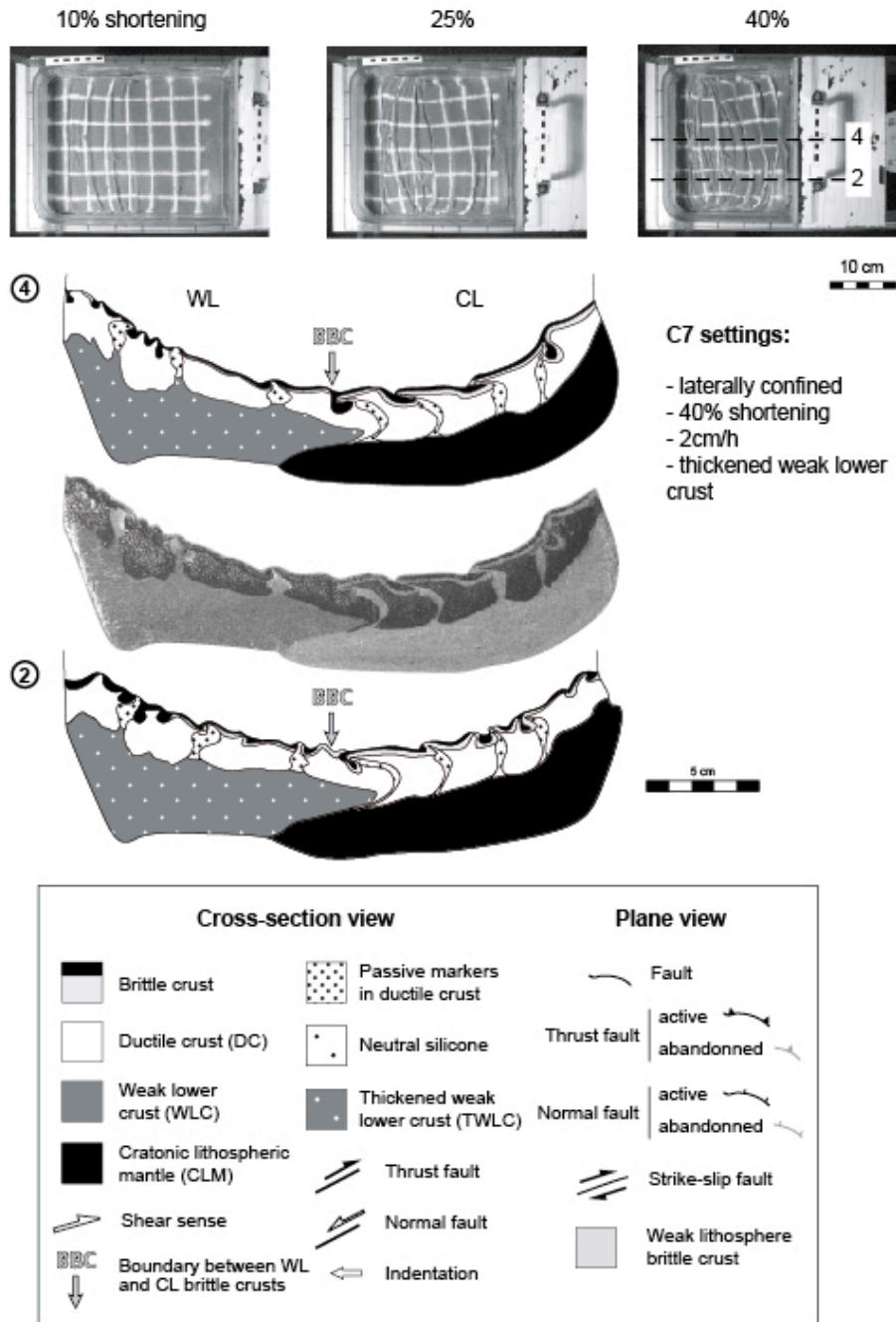


Figure S5. Results of experiment C7 illustrated by three interpreted top views in the upper panel, and two typical cross-sections including a photo in the lower panel.

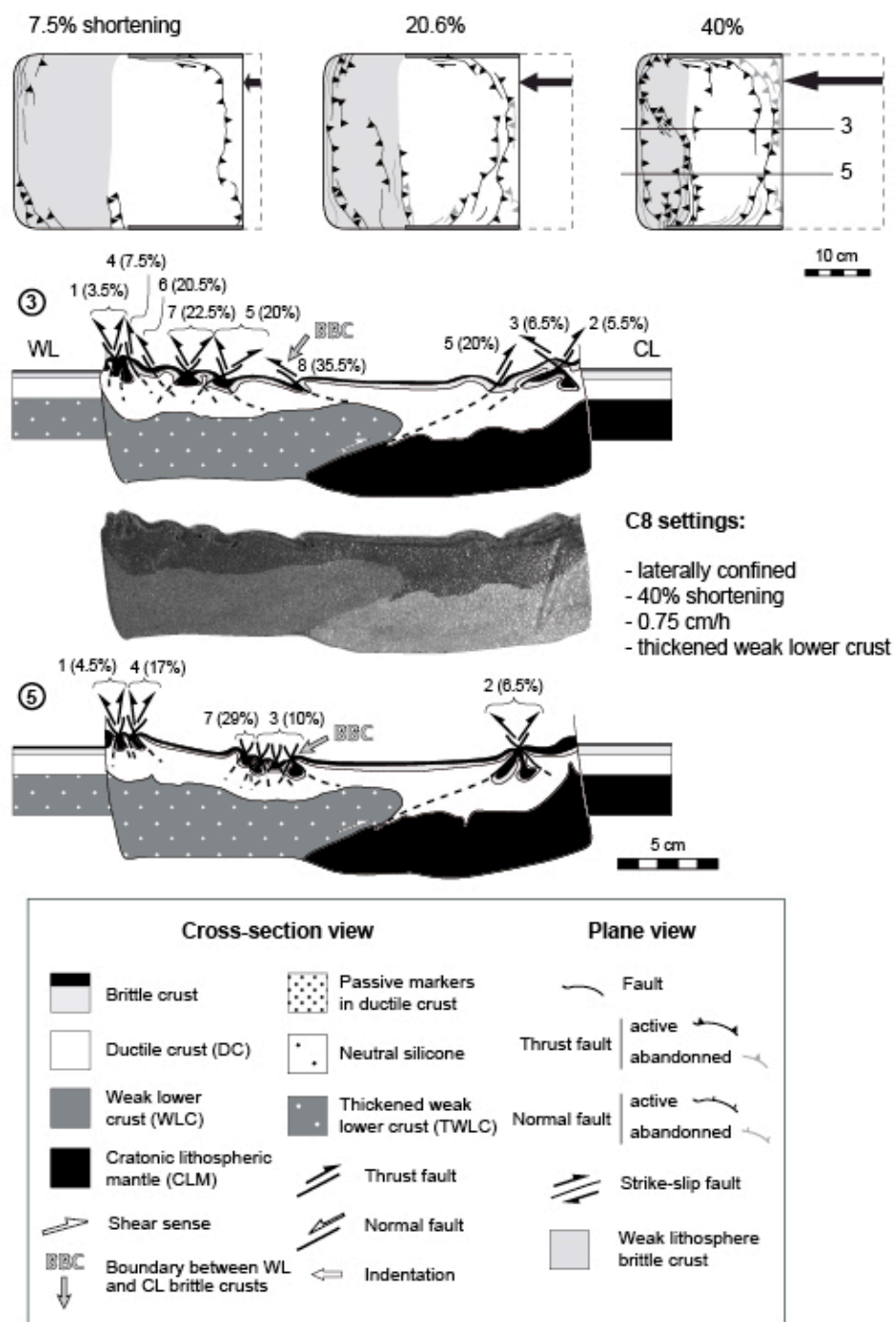


Figure S6. Results of experiment C8 illustrated by three interpreted top views in the upper panel, and two typical cross-sections including a photo in the lower panel.

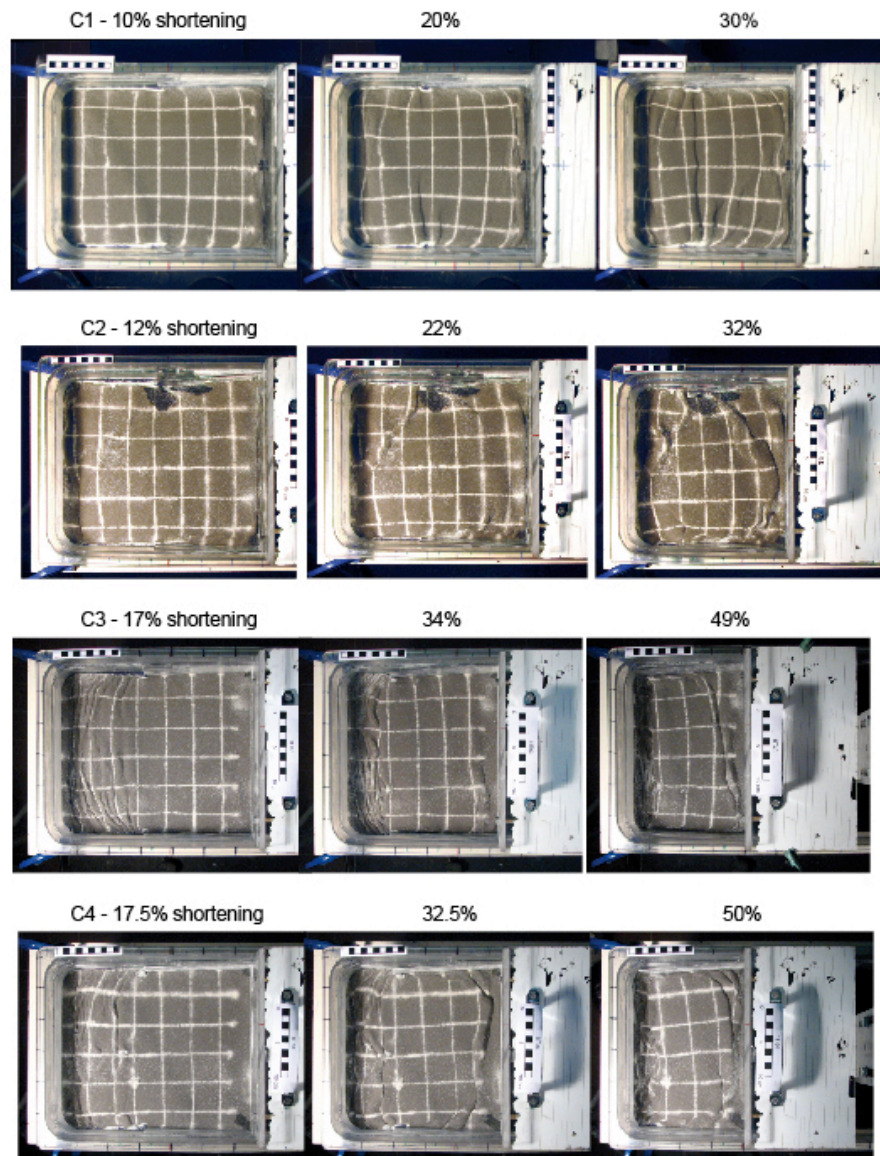


Figure S7. Top view photos of experiments C1 to C4.

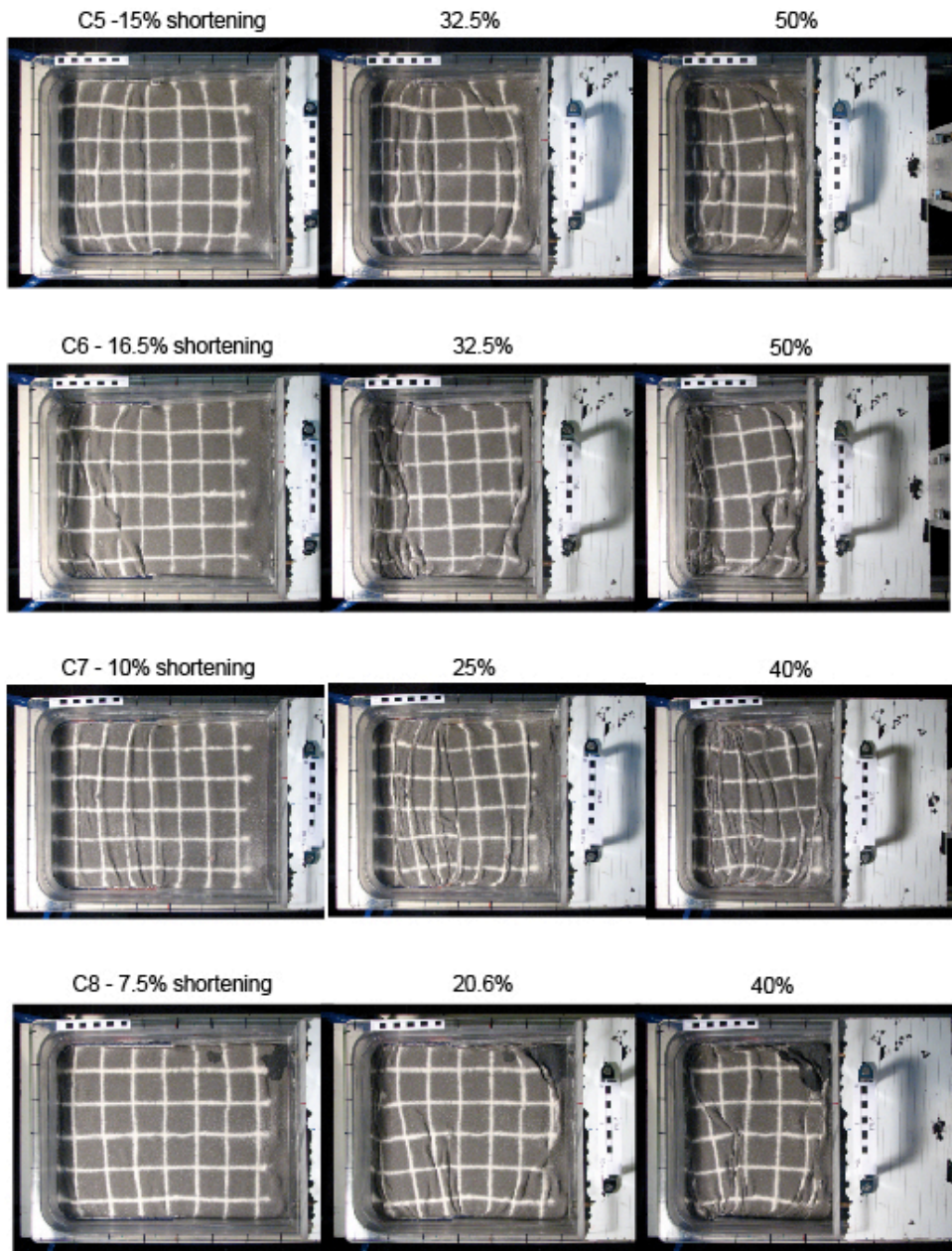


Figure S8. Top view photos of experiments C5 to C8.

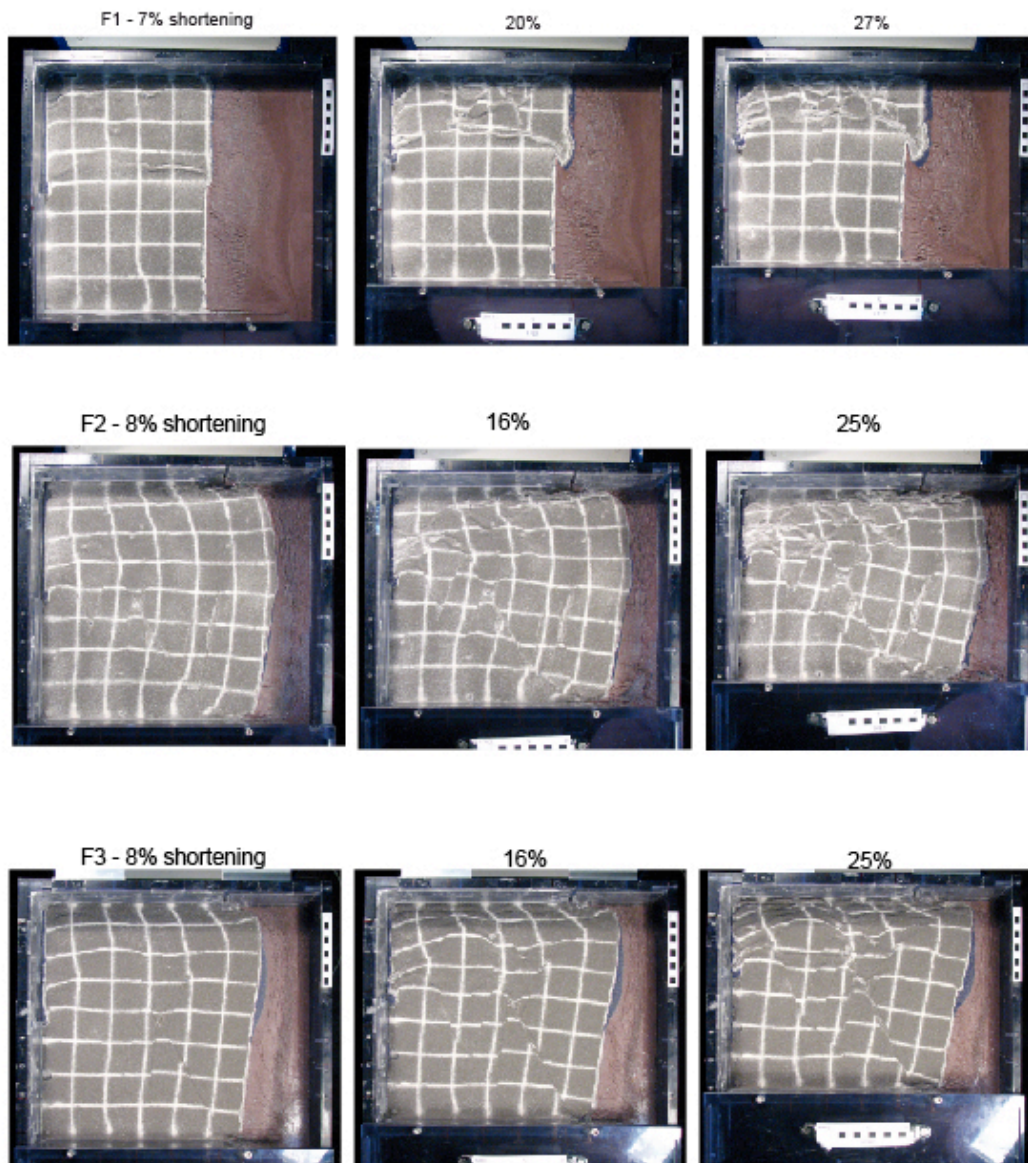


Figure S9. Top view photos of experiments F1 to F3.

litho.	layer	CS	L0	L	lx	A0	A	1+ey	ly	T0	T	lz	e1-e2	e2-e3	K	goct	es
WL	DC	1	19	11.2	0.35	15.2	11.3	1.3	1.8	0.8	1	1.6	0.15	1.50	0.10	1.5	1.3
		2	19	11	0.34	15.2	11.6	1.3	1.7	0.8	1.1	1.9	0.10	1.63	0.06	1.6	1.4
		3	19	11.4	0.36	15.2	11.1	1.4	1.9	0.8	1	1.6	0.18	1.47	0.12	1.5	1.3
		4	19	11.4	0.36	15.2	11.2	1.4	1.8	0.8	1	1.6	0.16	1.47	0.11	1.5	1.3
		5	19	11.9	0.39	15.2	11.3	1.3	1.8	0.8	1	1.6	0.15	1.38	0.11	1.4	1.2
		6	19	11.5	0.37	15.2	10.3	1.5	2.2	0.8	0.9	1.3	0.54	1.24	0.44	1.5	1.3
		7	19	11	0.34	15.2	8.8	1.7	3.0	0.8	0.8	1.0	1.09	1.09	1	1.8	1.5
	LC	1	19	11	0.34	22.8	13.8	1.7	2.7	1.2	1.4	1.4	0.70	1.40	0.50	1.7	1.5
		2	19	10.8	0.32	22.8	12.8	1.8	3.2	1.2	1.2	1.0	1.15	1.13	1.02	1.9	1.6
		3	19	11	0.34	22.8	14	1.6	2.7	1.2	1.3	1.2	0.82	1.25	0.65	1.7	1.5
		4	19	11	0.34	22.8	13.5	1.7	2.9	1.2	1.35	1.3	0.81	1.33	0.61	1.8	1.5
		5	19	11.7	0.38	22.8	14.5	1.6	2.5	1.2	1.2	1.0	0.91	0.97	0.93	1.5	1.3
		6	19	11.1	0.34	22.8	12.8	1.8	3.2	1.2	1.2	1.0	1.15	1.07	1.07	1.8	1.6
		7	19	9.9	0.27	22.8	11.9	1.9	3.7	1.2	1.2	1.0	1.30	1.30	1.00	2.1	1.8
	Total	1	19	11.1	0.34	38	25.1	1.5	2.3	2	2.4	1.4	0.46	1.44	0.32	1.6	1.4
		2	19	10.9	0.33	38	24.4	1.6	2.4	2	2.3	1.3	0.61	1.39	0.44	1.7	1.4
		3	19	11.2	0.35	38	25.1	1.5	2.3	2	2.3	1.3	0.55	1.34	0.41	1.6	1.4
		4	19	11.2	0.35	38	24.7	1.5	2.4	2	2.4	1.4	0.54	1.38	0.39	1.6	1.4
		5	19	11.8	0.39	38	25.8	1.5	2.2	2	2.2	1.2	0.58	1.14	0.51	1.4	1.2
		6	19	11.3	0.35	38	23.1	1.6	2.7	2	2.1	1.1	0.90	1.14	0.79	1.7	1.4
		7	19	10.45	0.30	38	20.7	1.8	3.4	2	2.0	1.0	1.21	1.20	1.02	2.0	1.7
CL	DC	1	20.5	18.2	0.79	16.4	14.2	1.2	1.33	0.8	0.9	1.27	0.05	0.47	0.11	0.5	0.4
		2	20.5	18.5	0.81	16.4	15	1.1	1.20	0.8	0.9	1.27	0.06	0.38	0.15	0.4	0.3
		3	20.5	18.2	0.79	16.4	13.7	1.2	1.43	0.8	0.7	0.77	0.60	0.03	20.57	0.6	0.5
		4	20.5	18.2	0.79	16.4	14.6	1.1	1.26	0.8	0.7	0.77	0.50	0.03	17.19	0.5	0.4
		5	20.5	17.2	0.70	16.4	11.9	1.4	1.90	0.8	0.7	0.77	0.91	0.08	10.82	0.9	0.8
		6	20.5	16.8	0.67	16.4	12.3	1.3	1.78	0.8	0.7	0.77	0.84	0.13	6.43	0.9	0.7
		7	20.5	15.6	0.58	16.4	12.4	1.3	1.75	0.8	0.7	0.77	0.83	0.28	2.96	0.9	0.8
	LM	1	20.5	18.6	0.82	43.05	26.4	1.6	2.66	2.1	1.7	0.66	1.17	0.23	5.14	1.2	1.1
		2	20.5	18.7	0.83	43.05	28	1.5	2.36	2.1	1.7	0.66	1.04	0.24	4.37	1.1	1.0
		3	20.5	18.7	0.83	43.05	27.2	1.6	2.51	2.1	1.5	0.51	1.10	0.49	2.25	1.3	1.2
		4	20.5	18.6	0.82	43.05	25.8	1.7	2.78	2.1	1.35	0.41	1.22	0.69	1.77	1.6	1.4
		5	20.5	17.6	0.74	43.05	25.1	1.7	2.94	2.1	1.4	0.44	1.38	0.51	2.74	1.6	1.4
		6	20.5	17.5	0.73	43.05	21.2	2.0	4.12	2.1	1.3	0.38	1.73	0.64	2.70	2.0	1.7
		7	20.5	16.2	0.62	43.05	20.2	2.1	4.54	2.1	1.3	0.38	1.98	0.49	4.06	2.1	1.9
	Total	1	20.5	18.4	0.81	59.45	40.6	1.5	2.14	2.9	2.6	0.80	0.98	0.002	435.03	0.9	0.8
		2	20.5	18.6	0.82	59.45	43	1.4	1.91	2.9	2.6	0.80	0.84	0.02	35.29	0.8	0.7
		3	20.5	18.5	0.81	59.45	40.9	1.5	2.11	2.9	2.2	0.58	0.96	0.34	2.81	1.1	1.0
		4	20.5	18.4	0.81	59.45	40.4	1.5	2.17	2.9	2.05	0.50	0.99	0.48	2.07	1.2	1.1
		5	20.5	17.4	0.72	59.45	37	1.6	2.58	2.9	2.1	0.52	1.28	0.32	4.02	1.4	1.2
		6	20.5	17.2	0.70	59.45	33.5	1.8	3.15	2.9	2	0.48	1.50	0.39	3.89	1.6	1.4
		7	20.5	15.9	0.60	59.45	32.6	1.8	3.33	2.9	2	0.48	1.71	0.23	7.28	1.7	1.5

Table S10. Finite strain parameters for experiment F2 (lateral escape, velocity of shortening 2cm/h) represented in Figure 9. As explained in Appendix A, the serial cross-sections performed at the end of the experiment allow to measure lengths, thicknesses and areas for each ductile layer of the weak and cratonic lithospheres, from the confined side (cross-section 1; Figure 6) to the free boundary (cross-section 7; Figure 6). Shapes of the 3D ellipsoids illustrated in Figure 9 are determined by K, the Flinn parameter, which is derived from lambda in x, y and z directions. We detail here the measures of initial and final dimensions in each direction, and the values of $1+\epsilon$ ($1+e$) and lambda used to determine K. Equations are developed in Appendix A.

Column "litho": type of lithosphere; WL: weak lithosphere; CL: cratonic lithosphere.

Column "layer": layer; DC: ductile crust; LC: lower crust; Total: calculation for the whole lithosphere; LM: lithospheric mantle.

Column "CS": cross-section, from number 1 located near the confining wall to number 7 near the free-boundary.

Column "L0": Initial length of layer (cm).

Column "L": Final length of layer (cm).

Column "lx": Finite elongation in the direction of shortening (lambda x).

Column "A0": Initial cross-sectional area (cm²).

Column "A": Final cross-sectional area (cm²).

Column "1+ey": $1+e_y$ value calculated from A and A0 (see Appendix A).

Column "ly": Finite elongation in the direction of lateral escape (lambda y).

Column "T0": Initial thickness (cm).

Column "T": Final thickness (cm).

Column "lz": Finite elongation in the vertical direction (lambda z).

Column "e1-e2": Value of $\epsilon_1 - \epsilon_2$, equivalent to $\ln(\lambda_1/\lambda_2)$.

Column "e2-e3": Value of $\epsilon_2 - \epsilon_3$, equivalent to $\ln(\lambda_2/\lambda_3)$. Alongside with $\epsilon_1 - \epsilon_2$, gives the type of ellipsoid on a Flinn diagram.

Column "K": Flinn's K parameter defining the aspect ratio of the strain ellipsoids.

Column "goct": Natural octahedral unit shear γ_{oct} (Nadai coefficient).

Column "es": Amount of strain ϵ_s (Nadai coefficient).

litho	layer	CS	L0	L	lx	A0	A	1+ey	ly	T0	T	lz	e1-e2	e2-e3	K	goct	es
WL	DC	1	19	10.6	0.31	19	12.4	1.5	2.3	1	1.4	2.0	0.18	1.84	0.10	1.8	1.6
		2	19	11.3	0.35	19	12.5	1.5	2.3	1	1.1	1.2	0.65	1.23	0.53	1.6	1.3
		3	19	11.5	0.37	19	13.8	1.4	1.9	1	1.1	1.2	0.45	1.19	0.38	1.4	1.2
		4	19	12.5	0.43	19	13.4	1.4	2.0	1	1	1.0	0.70	0.84	0.83	1.3	1.1
		5	19	12.1	0.41	19	11.6	1.6	2.7	1	0.9	0.81	1.20	0.69	1.73	1.6	1.4
		6	19	12	0.40	19	10.4	1.8	3.3	1	0.9	0.81	1.42	0.71	2.00	1.8	1.5
	LC	1	19	11.1	0.34	19	12.7	1.5	2.2	1	1.2	1.4	0.44	1.44	0.31	1.6	1.4
		2	19	11.7	0.38	19	12.8	1.5	2.2	1	1.2	1.4	0.43	1.33	0.32	1.5	1.3
		3	19	11.5	0.37	19	13.3	1.4	2.0	1	1.2	1.4	0.35	1.37	0.25	1.5	1.3
		4	19	11.9	0.39	19	14.1	1.3	1.8	1	1.1	1.2	0.41	1.13	0.36	1.3	1.1
		5	19	11.7	0.38	19	12.3	1.5	2.4	1	1	1.0	0.87	0.97	0.90	1.5	1.3
		6	19	11.4	0.36	19	12	1.6	2.5	1	0.9	0.81	1.13	0.81	1.39	1.6	1.4
	Total	1	19	10.85	0.33	38	25.1	1.51	2.3	2	2.6	1.7	0.30	1.65	0.19	1.7	1.5
		2	19	11.5	0.37	38	25.3	1.50	2.3	2	2.3	1.3	0.53	1.28	0.42	1.5	1.3
		3	19	11.5	0.37	38	27.1	1.40	2.0	2	2.3	1.3	0.40	1.28	0.31	1.4	1.2
		4	19	12.2	0.41	38	27.5	1.38	1.9	2	2.1	1.1	0.55	0.98	0.56	1.3	1.1
		5	19	11.9	0.39	38	23.9	1.59	2.5	2	1.9	0.9	1.03	0.83	1.24	1.5	1.3
		6	19	11.7	0.38	38	22.4	1.70	2.9	2	1.8	0.8	1.27	0.76	1.67	1.7	1.4
CL	DC	1	20.5	19	0.86	20.5	14.5	1.4	2.0	1	0.8	0.64	0.84	0.29	2.87	1.0	0.8
		2	20.5	18.6	0.82	20.5	13.5	1.5	2.3	1	0.7	0.49	1.03	0.52	1.99	1.3	1.1
		3	20.5	18.4	0.81	20.5	13.2	1.6	2.4	1	0.8	0.64	1.10	0.23	4.76	1.2	1.0
		4	20.5	17.3	0.71	20.5	11.8	1.7	3.0	1	0.6	0.36	1.44	0.68	2.12	1.8	1.5
		5	20.5	17.5	0.73	20.5	14.3	1.4	2.1	1	0.8	0.64	1.04	0.13	7.99	1.0	0.9
		6	20.5	15.6	0.58	20.5	11	1.9	3.5	1	0.6	0.36	1.79	0.48	3.77	2.0	1.7
	LM	1	20.5	18.5	0.814	41	30	1.4	1.9	2	1.8	0.810	0.83	0.01	153.35	0.8	0.7
		2	20.5	18.2	0.788	41	29.6	1.4	1.9	2	1.7	0.723	1.04	0.09	11.91	1.0	0.8
		3	20.5	18.7	0.832	41	29.6	1.4	1.9	2	1.7	0.723	1.79	0.14	12.68	1.4	1.2
		4	20.5	18	0.771	41	27.6	1.5	2.2	2	1.5	0.563	0.83	0.32	2.63	1.1	0.9
		5	20.5	17.8	0.754	41	26.3	1.6	2.4	2	1.6	0.640	0.83	0.16	5.07	1.1	0.9
		6	20.5	16	0.609	41	22.2	1.8	3.4	2	1.5	0.563	0.89	0.08	11.16	1.3	1.2
	Total	1	20.5	18.75	0.84	61.5	44.5	1.38	1.91	3	2.6	0.75	0.83	0.11	7.66	0.8	0.7
		2	20.5	18.4	0.81	61.5	43.1	1.43	2.04	3	2.4	0.64	0.93	0.23	4.03	1.0	0.9
		3	20.5	18.55	0.82	61.5	42.8	1.44	2.06	3	2.5	0.69	0.92	0.16	5.61	1.0	0.8
		4	20.5	17.65	0.74	61.5	39.4	1.56	2.44	3	2.1	0.49	1.19	0.41	2.87	1.4	1.2
		5	20.5	17.65	0.74	61.5	40.6	1.51	2.29	3	2.4	0.64	1.13	0.15	7.69	1.1	1.0
		6	20.5	15.8	0.59	61.5	33.2	1.85	3.43	3	2.1	0.49	1.75	0.19	9.11	1.8	1.5

Table S11. Finite strain parameters for experiment F3 (lateral escape, velocity of shortening 0.75cm/h) represented in Figure 9. Columns are the same as in the Table S10. Equations are developed in Appendix A.

t	Sh	Set	Se	Er	SP	ST	T/E
1.3	2.5	10.6	10.6	8.1	24.7	14.1	1.33
2.6	5	17.8	7.2	5.5	49.4	31.6	1.77
4.0	7.5	20.5	2.7	2.1	74.1	53.6	2.61
5.3	10	23.6	3.1	2.4	98.8	75.2	3.18
6.6	12.5	28.6	5	3.8	123.4	94.8	3.32
7.9	15	32.6	4	3.0	148.1	115.5	3.54
9.2	17.5	39.1	6.5	4.9	172.8	133.7	3.42
10.5	20	42.8	3.7	2.8	197.5	154.7	3.61
11.9	22.5	49.4	6.6	5.0	222.2	172.8	3.50
13.2	25	55	5.6	4.3	246.9	191.9	3.49
14.5	27.5	62.9	7.9	6.0	271.6	208.7	3.32
15.8	30	69.4	6.5	4.9	296.3	226.9	3.27
17.1	32.5	75.4	6	4.6	320.9	245.5	3.26
18.4	35	82.3	6.9	5.2	345.6	263.3	3.20
19.8	37.5	90.9	8.6	6.5	370.3	279.4	3.07
21.1	40	98.3	7.4	5.6	395.0	296.7	3.02

Table S12. Measurements of escaped surface, lateral escape rate and extrusion vs. thickening ratios for experiment F1 (lateral escape, 40% of shortening at 2cm/h) plotted in Figure 10ad.

Column "t": Time (h).

Column "Sh": Percentage of shortening.

Column "Set": Total escaped surface (cm²).

Column "Se": Escaped surface at each step (cm²).

Column "Er": Escape rate (cm/h).

Column "SP": Cumulated surface lost by advance of the piston (cm²).

Column "ST": Surface change absorbed by thickening (cm²).

Column "T/E": Thickening vs. escape ratio.

t	Sh	Set	Se	Er	SP	ST	T/E
1.3	2.5	82	82	62.3	30.6	-51.4	-0.63
2.6	5	108.5	26.5	20.1	61.2	-47.3	-0.44
4.0	7.5	124.2	15.7	11.9	91.8	-32.4	-0.26
5.3	10	134	9.8	7.4	122.5	-11.6	-0.09
6.6	12.5	140.2	6.2	4.7	153.1	12.9	0.09
7.9	15	145.8	5.6	4.3	183.7	37.9	0.26
9.2	17.5	150.9	5.1	3.9	214.3	63.4	0.42
10.5	20	155.7	4.8	3.6	244.9	89.2	0.57
11.9	22.5	157.5	1.8	1.4	275.5	118.0	0.75
13.2	25	158.2	0.7	0.5	306.1	147.9	0.94

Table S13. Measurements of escaped surface, lateral escape rate and extrusion vs. thickening ratios for experiment F2 (lateral escape, 25% of shortening at 2cm/h) plotted in Figure 10bd. Columns are the same as in Table S12.

t	Sh	Set	Se	Er	SP	ST	T/E
0.5	2.5	34.1	34.1	69.1	29.6	-4.5	-0.13
1.0	5	63.1	29	58.7	59.3	-3.9	-0.06
1.5	7.5	87.1	24	48.6	88.9	1.8	0.02
2.0	10	105.1	18	36.5	118.5	13.4	0.13
2.5	12.5	118	12.9	26.1	148.1	30.1	0.26
3.0	15	127.7	9.7	19.6	177.8	50.1	0.39
3.5	17.5	136.1	8.4	17.0	207.4	71.3	0.52
4.0	20	141.7	5.6	11.3	237.0	95.3	0.67
4.4	22.5	147.3	5.6	11.3	266.6	119.3	0.81
4.9	25	150.2	2.9	5.9	296.3	146.1	0.97

Table S14. Measurements of escaped surface, lateral escape rate and extrusion vs. thickening ratios for experiment F3 (lateral escape, 25% of shortening at 0.75cm/h) plotted in Figure 10cd. Columns are the same as in Table S12.