Journal of Geophysical Research: Solid Earth

Supporting information for

Validation of subgrain-size piezometry as a tool for measuring stress in polymineralic rocks

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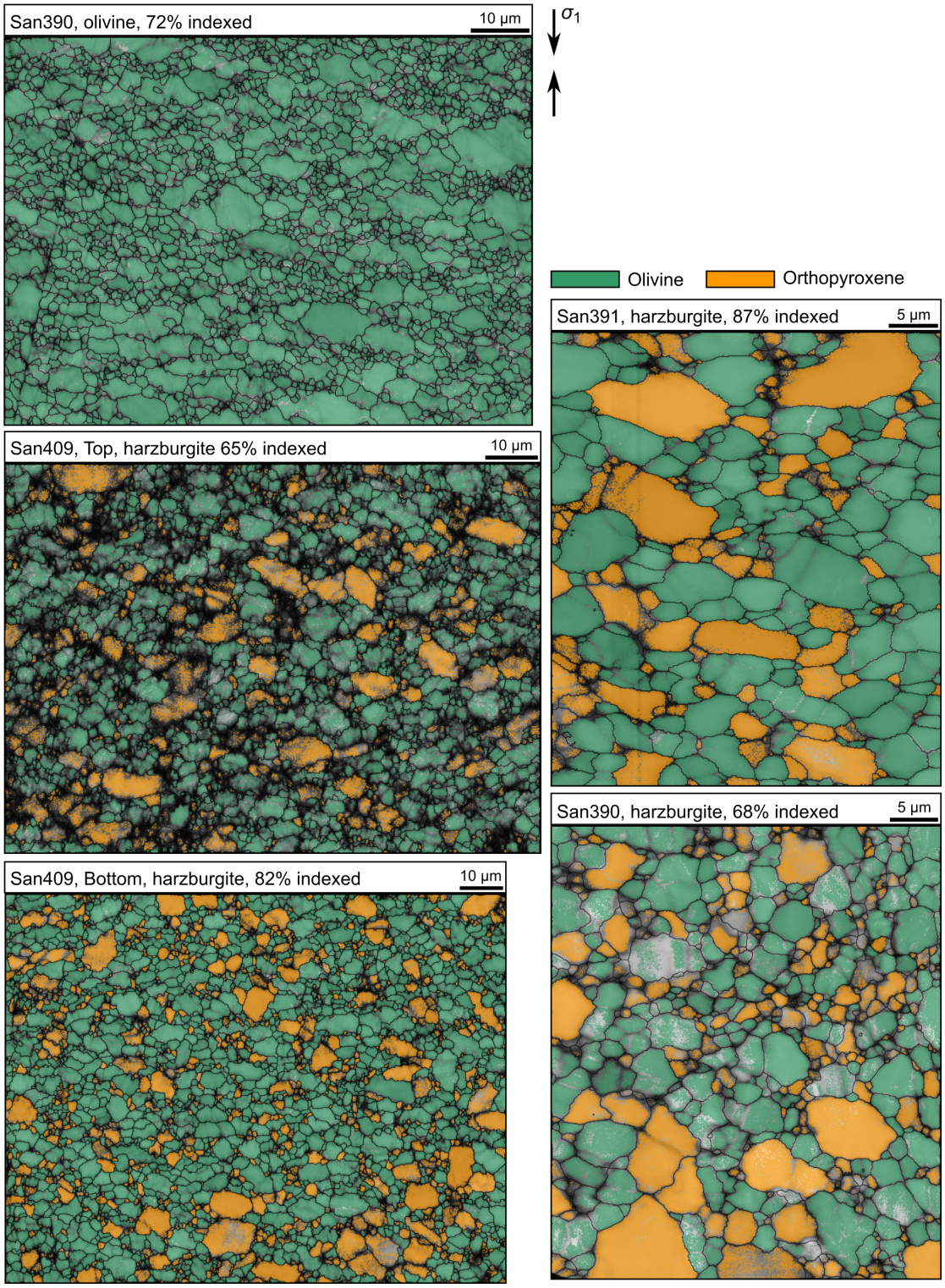
Additional Supporting Information (Files uploaded separately)

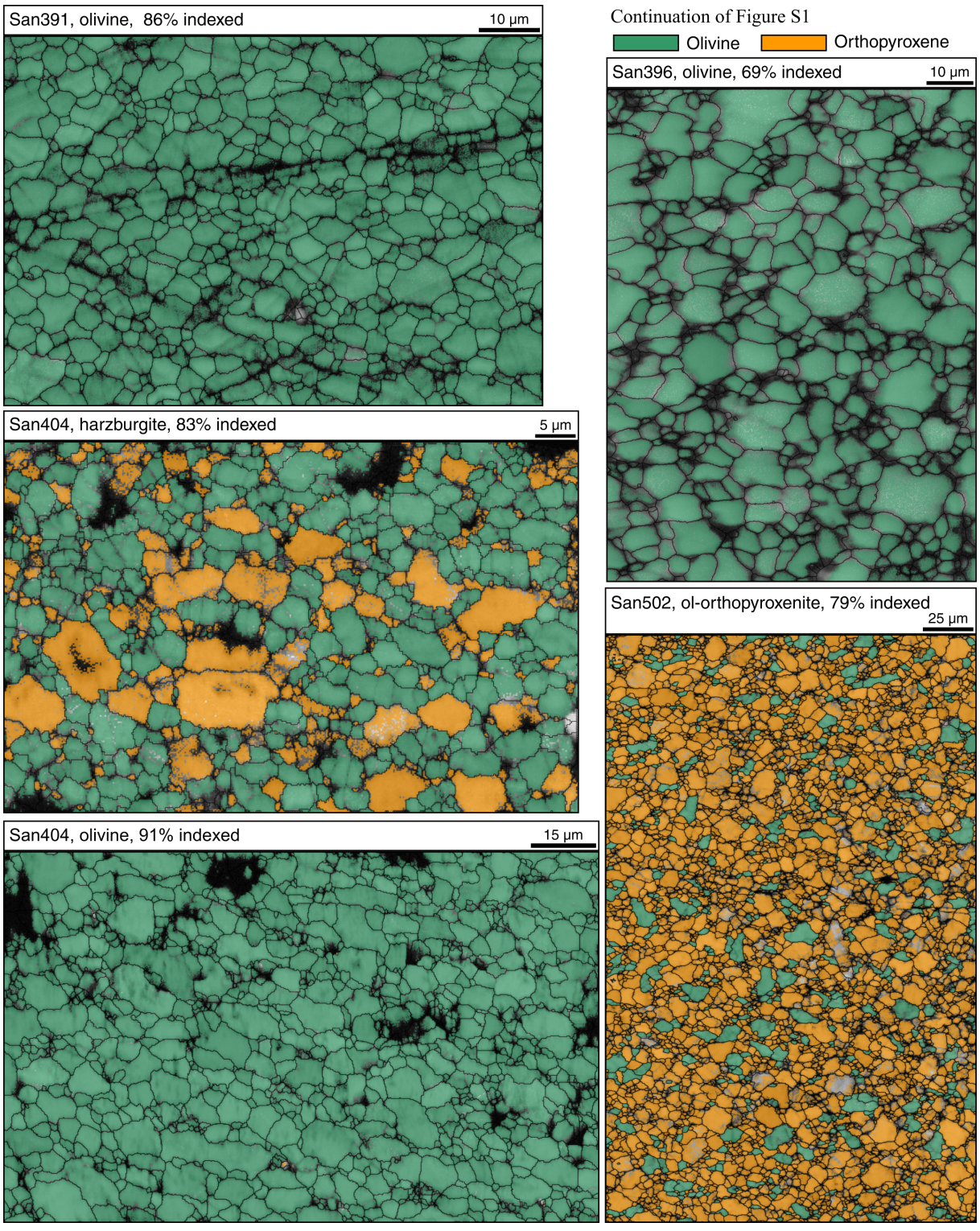
1. Table S4

Introduction

Supplementary material provides: phase maps of unfilled electron backscatter diffraction (EBSD) data (Figure S1); example of angular precision in EBSD map of experiment San409 (Figure S2); mechanical data, specifically plots of mean stress against time, for all experiments (Figure S3); table of EBSD collection conditions (Table S1); table of average stresses of each experiment, measured through X-ray diffraction (Table S2); table of the peak stresses of each experiment, measured through X-ray diffraction (Table S3); and caption for Table S4, which is uploaded separately in an Excel spreadsheet.

Figure S1: Phase maps of the unfilled EBSD data (after being subjected to the cleaning process described in Section 2.4). Grain boundaries, defined as having a misorientation angle of $\geq 15^{\circ}$, are drawn in black.





Continuation of Figure S1

Continuation of Figure S1

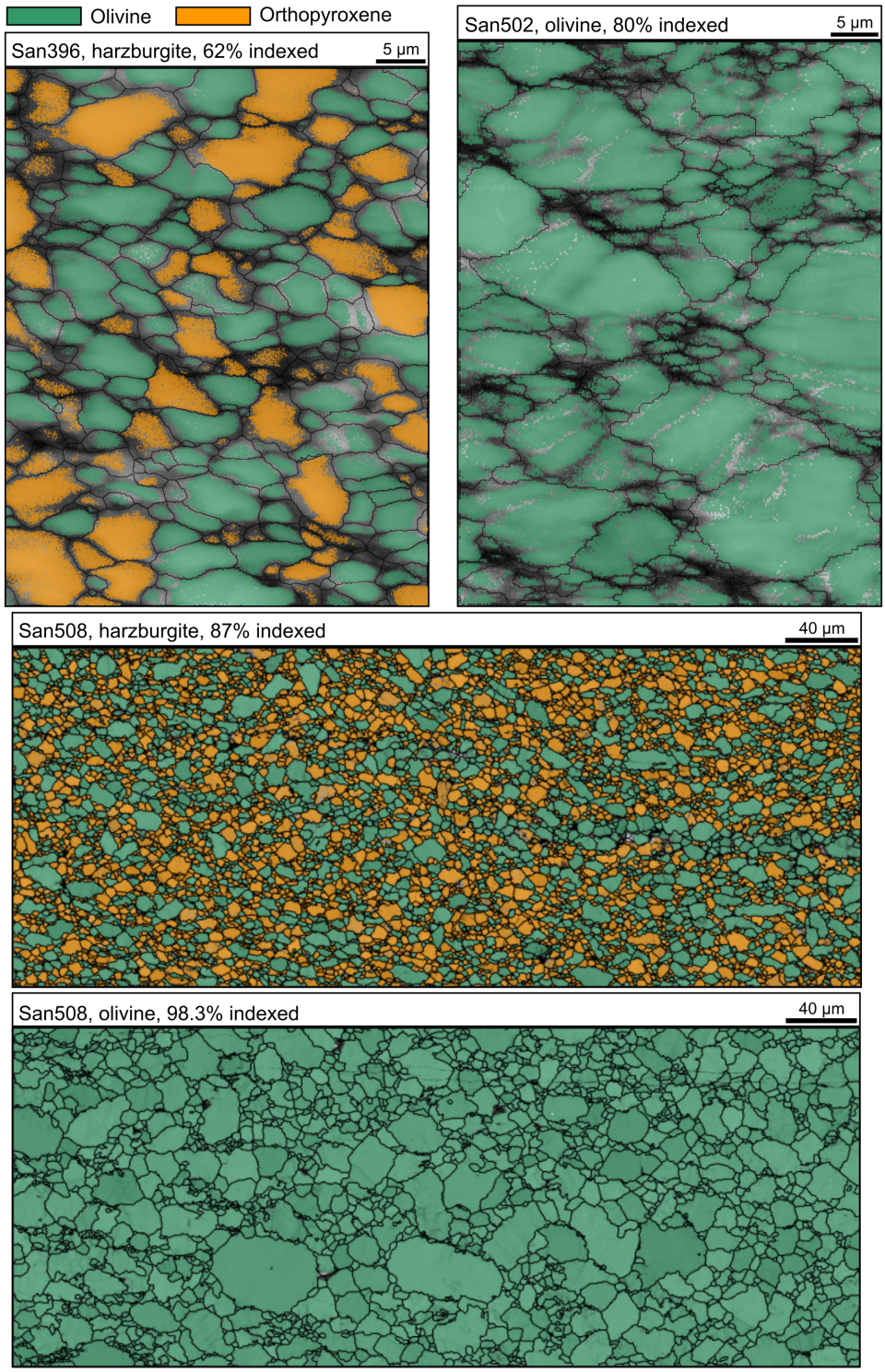


Figure S2: Local misorientation map from EBSD data of the top harzburgite sample in experiment San409. Misorientation profiles across two example grains are also displayed. Grain and subgrain boundaries are in black and white, respectively. Grain boundaries are defined as boundaries with misorientation angles of $\geq 15°$, while subgrain boundaries are defined as boundaries with misorientation angles of $\geq 1°$. The compressional axis is vertical.

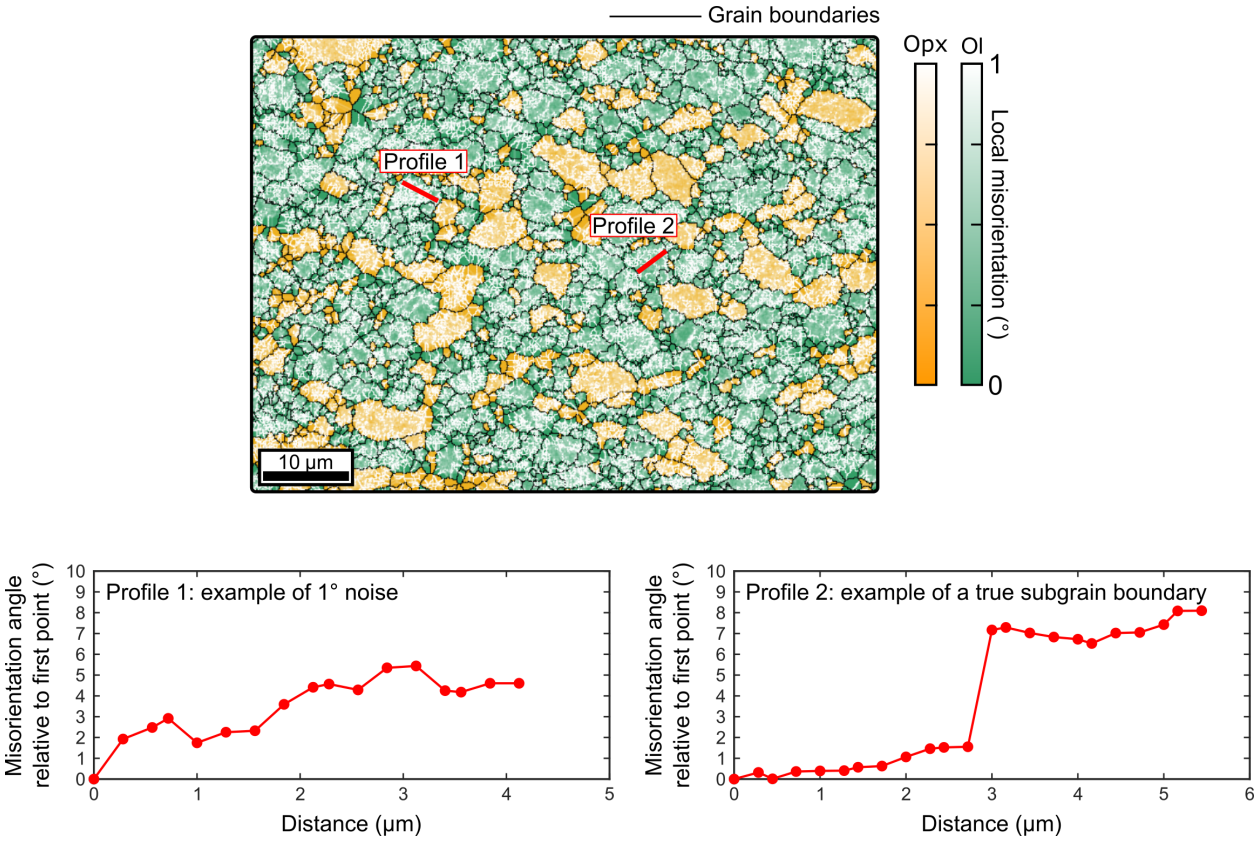


Figure S3: Mean stress plotted against time for all experiments. Mean stress was measured from X-ray diffraction on the {130} peak within olivine in both the stress sensor and, where possible, the mixture.

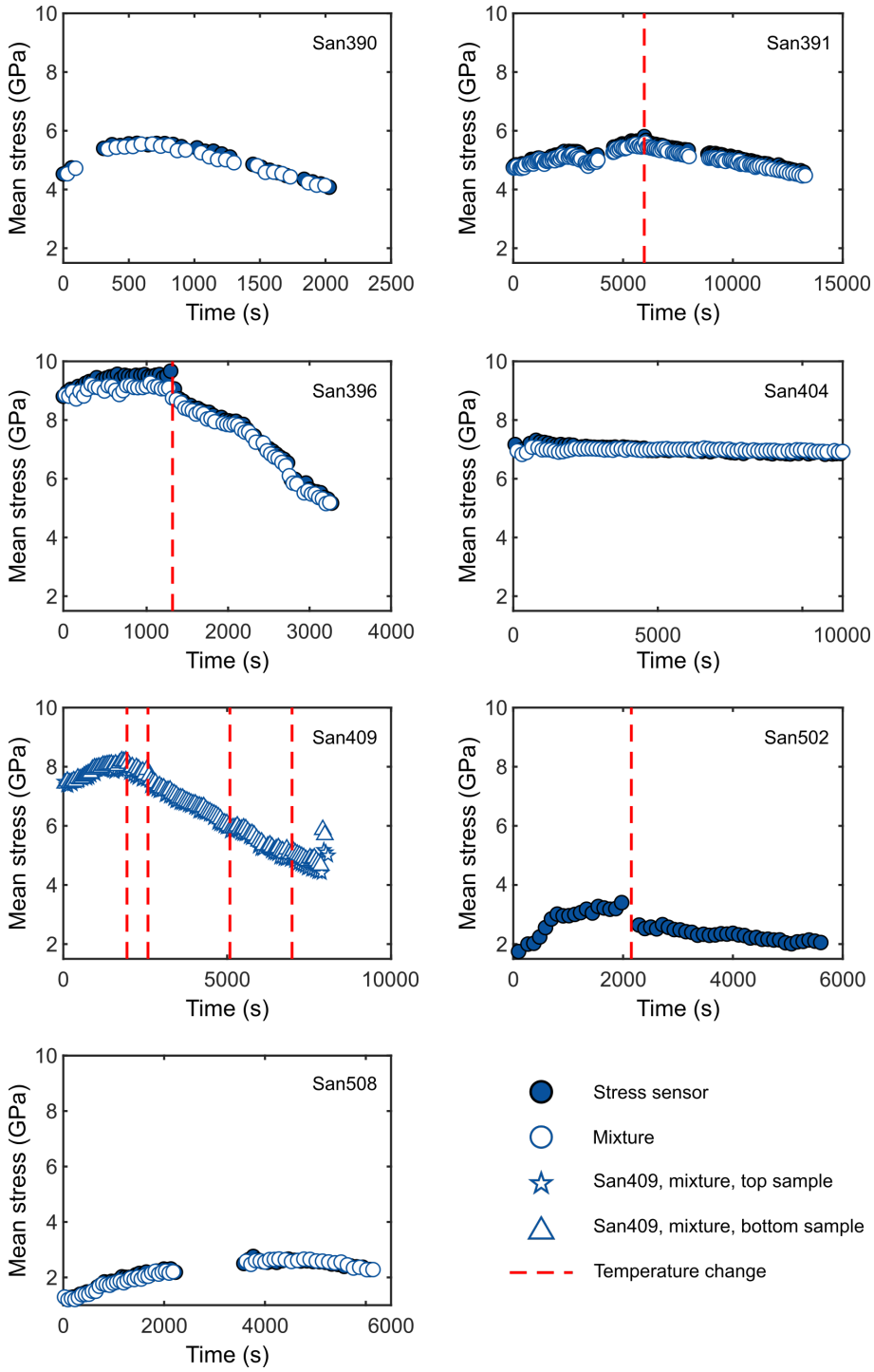


Table S1: Collection conditions

Experiment No.	Sample[a]	Filename	Collection location[b]	Accelerating voltage kV	Step size (µm)	Indexed pixels[d] (%)	MAD[c,d] Statistic
San390	OSS	San390_Ol_small_area2_rotated.ctf	UoO	30	0.1	72.0	0.40±0.33
San390	Mix	San390_Hz_rotated.ctf	UMN	20	0.075	68.0	0.51±0.38
San391	OSS	San391_Ol_close_rotated.ctf	UoO	30	0.1	86.0	0.45±0.30
San391	Mix	San391_hz_rotated.ctf	MBL	20	0.1	87.0	0.37±0.26
San396	OSS	San396_olivine_rotated.ctf	UMN	20	0.1	69.0	0.51±0.38
San396	Mix	San396_hz_rotated.ctf	UMN	20	0.1	62.0	0.41±0.36
San404	OSS	San404_Ol_rotated_sub.ctf	UoO	30	0.2	90.7	0.33±0.30
San404	Mix	San404_bot_Rotation_Hz.ctf	UoO	30	0.2	83.0	0.44±0.36
San409	Mix-Top	San409_top_rotated.ctf	UoO	30	0.2	65.0	0.63±0.53
San409	Mix-Bot	San409_bot_rotated.ctf	UoO	30	0.2	82.0	0.50±0.38
San502	OSS	San502_load_cell_rotated.ctf	MBL	30	0.2	80.0	0.51±0.36
San502	Mix	San502_orthopyroxene_remapped _subset_rotated.ctf	MBL	30	0.3	79.0	0.45±0.35
San508	OSS	San508_loadcell_500nm_rotated.ctf	MBL	20	0.5	98.3	0.29±0.21
San508	Mix	San508_mix_300nm_rotated.ctf	MBL	20	0.3	87.0	0.39±0.32

[a]OSS: Olivine stress sensor, Mix: Harzburgite or olivine orthopyroxenite

[b]UoO: University of Oxford, UMN: University of Minnesota, MBL: Marine Biology Laboratory, Woods Hole

[c]Mean angular deviation

[d]Calculated from EBSD data prior to cleaning and infilling in MTEX

Table S2: Peak stresses from X-ray diffraction, rounded to the nearest 10 MPa.

Experiment	Sample[a]	Peak stress: X-ray diffraction (MPa)					
		Olivine			Orthopyroxene		
		{112}	{131}	{130}	{421}	{610}	{321}
San390	OSS	590	700	720	-	-	-
	Mix	1140	1120	1590	1420	2100	1350
San391[b]	OSS	560	610	710	-	-	-
	Mix	750	640	910	980	1310	1010
San396	OSS	1130	1370	1480	-	-	-
	Mix	1490	1340	1750	-	-	-
San404	OSS	100	100	100	-	-	-
	Mix	530	470	600	610	720	770
San409	Mix-Top	1250	1510	1810	1490	2910	1630
	Mix-Bot	1180	1300	1680	1410	2420	1660
San502	OSS	830	1250	1300	-	-	-
	Mix	-	-	-	1110	1650	1270
San508	OSS	330	350	420	-	-	-
	Mix	430	250	340	410	370	360

[a]OSS: Olivine stress sensor, Mix: Harzburgite or olivine orthopyroxenite

[b]Ignoring anomalous data point

Table S3: Average stress measured from X-ray diffraction rounded to the nearest 10 MPa. The data used to calculated the average stress is indicated in the table.

Experiment	Sample[a]	Calculated from	Average stress: X-ray diffraction (MPa)					
			Olivine			Orthopyroxene		
			{112}	{131}	{130}	{421}	{610}	{321}
San390	OSS	whole experiment	470	520	540	-	-	-
	Mix	whole experiment	930	910	1360	1040	1730	1150
San391	OSS	after T step	250	240	260	-	-	-
	Mix	after T step	470	250	530	570	830	610
San396	OSS	after rate step	290	290	300	-	-	-
	Mix	after rate step	610	500	780	-	-	-
San404	OSS	after rate step	30	50	40	-	-	-
	Mix	after rate step	250	110	270	260	330	290
San409	Mix-Top	final 0.2 strain	360	200	430	340	660	320
	Mix-Bot	final 0.2 strain	250	180	380	290	690	410
San502	OSS	after T step	590	590	690	-	-	-
	Mix	after T step	-	-	-	620	1050	670
San508	OSS	after final rate step	250	240	260	-	-	-
	Mix	after final rate step	330	-50	250	190	280	170

[a]OSS: Olivine stress sensor, Mix: Harzburgite or olivine orthopyroxenite

Caption for Table S4, uploaded separately

Mean line-intercept length predicted using the 2°-subgrain-size piezometer, final stress measured from X-ray diffraction, and final pressure measured through X-ray diffraction of the {130} peak in olivine. A cross in the 'SGs' column indicates that the grain-size was large enough for subgrains to form in equilibrium with the final stress.