GSA DATA REPOSITORY 2011246

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APPENDIX DR1. EXPERIMENTAL DETAILS

Experiments were conducted in a Griggs-type apparatus on drilled cores and cold-pressed powders of antigorite serpentinite composed of ~90% antigorite, 5% Fe oxides, and minor magnesite, chromite and orthopyroxene (further details in Chernak and Hirth, 2010). Powders were sieved to isolate a grain size of $37 - 53 \mu m$ and then cold-pressed into cylinders at a pressure of ~380 MPa. Core and powdered samples had dimensions of $12.7 \times 6.3 mm$ and were jacketed in Ag. Pt discs were placed between the sample ends and ZrO₂ pistons. NaCl was used as the confining medium both inside and outside the furnace and sample temperature was measured using a Pt/Pt10%Rh thermocouple placed next to the center of the sample; temperature difference along the sample is less than 30 °C.

Temper	uure-r	amping	experii	nemis			T	T.M	D. (
Expt. Number	Press. (GPa)	Ramp Rate (°C/s)	700 °C [†] (min)	Strain Rate (s ⁻¹)	Unloading Slope (kN/mm)	Maximum Strength (MPa) [§]	l otal Strain (%)	T Where Rapid Weakening Initiated (°C)	Deformation Type (angle between σ_1 and fault(s))	Reaction Products											
											W1596	1.0	0.005	7	hydrostatic [#]		1135 at 10⁻⁵	19	NA	incipient faults (27° and 35°)	6%
											W1595	1.0	0.005	27	1.5 x 10 ^{-7#}	-200.58	1110 at 10 ⁻⁵	25	590	localized (25-30°)	9%
W1528 ^{**}	1.0	0.05	12	1.5 × 10⁻⁵	-52.55	930	25	630	incipient fault (38°)	4%											
W1531**	1.0	0.05	44	1.5 × 10⁻ ⁶	-146.63	820	25	540	localized (25°)	7%											
W1598 ^{††}	1.0	0.5	6	hydrostatic#		1070	17	NA	incipient fault (30°)	<1%											
W1529 ^{**}	1.0	0.5	6	1.5 × 10 ⁻⁴	-60.39	895	28	635	localized (33°)	6%											
W1599	1.0	0.5	0	1.5×10^{-5}	-181.12	1100	22	675	localized (31°)	<1%											
W1519 (60°)	1.0	0.5	9	$1.5\times10^{\text{-5}}$	-148.21	1110	25	530	localized (37°)	<1%											
W1513**	1.0	0.5	14	$1.5\times10^{\text{-5}}$	-181.76	1165	26	670	incipient fault (44°)	7%											
W1555	1.0	0.5	41	$1.5\times10^{\text{-5}}$	-184.53	1290	29	675	localized (43° and 7-36° curved fault)	11%											
W1536**	1.0	0.5	47	1.5×10^{-6}	-263.70	1150	25	675	incipient fault (36°)	7%											
W1578	1.5	0.5	25	1.5 × 10⁻⁵	-211.98	1225	24	660	localized (30°)	12%											
W1502##	1.5	0.5	118	hydrostatic#	-399.20	895	10	630	mostly distributed												
Other e.	xperim	ents																			
Experiment Number		Temperature (°C)		Pressure (GPa)	Strain Rate (s⁻¹)	Strain Rate Total St (s ⁻¹) (%)		n Deformation Type													
W1590 (Balsam		400		1.0	1.5 × 10⁻⁵	12		localized (43°)													
Gap dunite	e core ^{ss})				1.5×10^{-5}			()													
W1580		700		1.0	1.5×10^{-6} .	29		localized (25-30°)													
					1.5 × 10 ⁻⁵																
					1.5 × 10⁻⁵,																
W1517		700		1.5	1.5 × 10 ⁻⁶ ,	19		localized (26°)													
					1.5 × 10⁻⁵																

Table DR1. Experimental Details

Temperature-ramping experiments

^{*}Number or symbol in parentheses after sample number indicates the orientation of the foliation relative to σ_1 for drilled core sample. [†]Samples continued to deform.

[§]Maximum strength prior to temperature ramping.

[#]W1596: deformed to 19% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1595: deformed to 21% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1598: deformed to 17% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp; W1502: deformed to 10% strain at 1.5 × 10⁻⁵ s⁻¹ prior to T ramp.

**Volume % of magnesite is >20% in starting antigorite powder.

^{+†}Sample was deformed at 1.5 × 10⁻⁵ s⁻¹ until 438 °C before unloading and subsequent temperature ramping.

¹¹Dunite core was heat treated for 24 h at 1000 °C in a controlled CO₂/CO atmosphere furnace set to maintain an oxygen fugacity between the Fe-FeO and Ni-NiO buffers.

^{§§}Sample was deformed at 300 °C prior to temperature ramp.

APPENDIX DR2. STRESS-STRAIN CURVES



Figure DR1. Stress-strain curves showing sample strength before, during and after temperature ramping; subset of experiments is the same as shown in Figure 2B. The pressure increase associated with increasing temperature was subtracted from stress values.

APPENDIX DR3. RAMP RATE/STRAIN RATE VERSUS UNLOADING SLOPE



Figure DR2. Ramp rate/strain rate versus negative unloading slope. Data symbols are colored based on the strain rate during temperature ramping. Gray bar shows apparatus stiffness. To plot a value for W1502, where deformation was not imposed during temperature ramping, we

used a strain rate of 1.5×10^{-7} s⁻¹, which is a maximum value. While we acknowledge that the sample can creep when the deformation piston is not advancing, the strain rate would be smaller than that at an imposed strain rate of 1.5×10^{-7} s⁻¹; the actual ratio of ramp rate/strain rate for W1502 is higher than the value plotted, as indicated by the arrow The unloading slope for W1502 is more uncertain owing to complications related to piston friction.