

Fluid-induced fault reactivation due to brucite + antigorite dehydration triggered the Mw7.1 September 19th Puebla-Morelos (Mexico) intermediate-depth earthquake

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Introduction

This file includes the model outputs from our phase-equilibrium modeling, i.e. the pressure and temperature phase diagrams for three bulk-rock compositions, the whole-rock compositions used for the phase equilibria calculations, and all the tables with the data needed to reproduce the petrophysical properties shown in Figure 3.

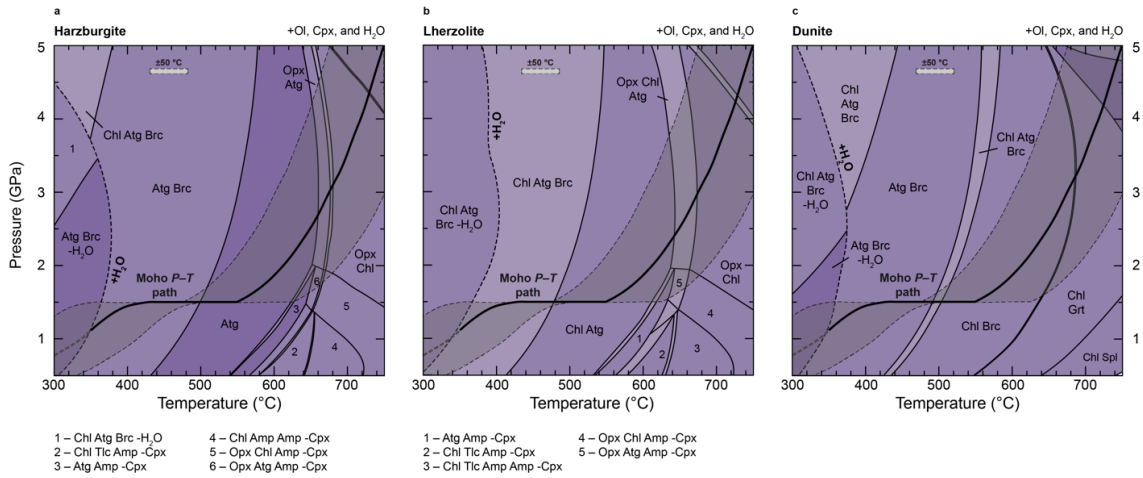


Figure S1. Pressure–temperature (P – T) phase diagrams calculated for a (a) harzburgite, (b) lherzolite, and (c) dunite in the CaO – FeO – MgO – Al_2O_3 – SiO_2 – H_2O system. The grey bar shows the uncertainty associated with the phase equilibrium modeling (± 50 °C; Powell & Holland, 2008). The black solid line shows the Moho P – T path from Manea & Manea (2011), and the shaded area shows the uncertainty associated with the thermal model (± 75 °C; Peacock, 2009)

Table S1. Modeled mantle bulk-rock compositions (wt.%).

	Harzburgite	Lherzolite	Dunite
SiO ₂	38.52	39.54	34.46
Al ₂ O ₃	0.68	2.90	0.85
FeO	7.04	8.09	10.35
MgO	39.37	36.33	39.72
CaO	0.80	0.66	0.26
H ₂ O	13.60	12.48	14.37
Total	100.00	100.00	100.00
X _{Mg}	0.85	0.82	0.79

$X_{Mg} = \text{MgO}/(\text{MgO}+\text{FeO})$

Table S1. Modeled mantle bulk-rock compositions (wt.%).

Table S2. H₂O content evolution during subduction of the wet ultramafic portion of the Cocos oceanic lithospheric mantle.

Depth (km)	Temperature (°C)	Harzburgite	Lherzolite	Dunite	Serpentinization (%)*			
					20	40	60	80
37.5	350	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40.2	360	0.048	0.060	0.081	0.000	0.000	0.000	0.000
42.8	370	0.067	0.082	0.092	0.000	0.000	0.000	0.000
45.0	380	0.056	0.068	0.059	0.000	0.000	0.000	0.000
46.9	390	0.081	0.097	0.119	0.000	0.000	0.000	0.000
48.4	400	0.090	0.110	0.130	0.000	0.000	0.000	0.000
49.4	410	0.121	0.138	0.172	0.000	0.000	0.000	0.000
50.1	420	0.192	0.215	0.281	0.000	0.000	0.000	0.000
50.5	430	0.143	0.162	0.208	0.000	0.000	0.000	0.000
50.5	440	0.379	0.400	0.546	0.000	0.000	0.000	0.000
50.5	450	0.392	0.402	0.557	0.000	0.000	0.000	0.000
50.5	460	0.311	0.336	0.460	0.000	0.000	0.000	0.000
50.5	470	1.349	0.790	1.592	0.000	0.000	0.000	0.000
50.5	480	1.044	0.676	1.218	0.000	0.000	0.000	1.293
50.5	490	1.637	0.007	1.612	0.000	0.000	0.116	2.056
50.5	500	2.259	0.008	4.870	0.000	0.000	2.657	2.097
50.5	510	0.000	0.007	1.429	0.000	0.000	0.000	0.000
50.5	520	0.000	0.008	0.002	0.000	0.000	0.000	0.000
50.5	530	0.000	0.007	0.002	0.000	0.000	0.000	0.000
50.5	540	0.000	0.007	0.001	0.000	0.000	0.000	0.000
50.7	550	0.000	0.008	0.001	0.000	0.000	0.000	0.000
52.2	560	0.000	0.004	0.001	0.000	0.000	0.000	0.000
54.1	570	0.000	0.004	0.000	0.000	0.000	0.000	0.000
56.4	580	0.000	0.003	0.001	0.000	0.000	0.000	0.000
59.2	590	0.000	0.003	0.001	0.000	0.000	0.000	0.000
62.4	600	0.000	0.002	0.001	0.000	0.000	0.000	0.000
66.1	610	0.000	0.002	0.001	0.000	0.000	0.000	0.000
70.2	620	0.000	0.001	0.001	0.000	0.000	0.000	0.000
74.7	630	0.000	0.000	0.001	0.000	0.000	0.000	0.000
79.7	640	0.000	0.000	0.001	0.000	0.000	0.000	0.000
85.1	650	0.000	0.928	0.001	0.000	0.000	0.000	0.000
91.0	660	0.024	1.699	0.002	0.000	0.000	0.028	0.034
97.3	670	1.410	2.708	0.003	0.000	1.241	1.404	1.398
104.0	680	2.729	1.126	0.004	1.593	2.704	2.732	2.738
111.2	690	0.540	0.005	0.184	0.530	0.539	0.537	0.532
119.1	700	0.004	0.006	0.008	0.004	0.004	0.004	0.004
127.5	710	0.004	0.009	0.014	0.004	0.004	0.004	0.004
136.6	720	0.005	0.011	0.033	0.005	0.005	0.005	0.005
146.7	730	0.009	2.084	0.064	0.009	0.009	0.009	0.009
157.7	740	0.530	0.177	0.035	0.530	0.530	0.530	0.530
170.0	750	0.000	0.000	0.060	0.000	0.000	0.000	0.000

*Percent of water considered in the model for the harzburgite. See text for details.

Table S2. H₂O content evolution during subduction of the wet ultramafic portion of the Cocos oceanic lithospheric mantle

Table S3. Volumetric evolution during subduction of the wet ultramafic portion of the Cocos oceanic lithospheric mantle (dV in %).

Depth (km)	Temperature (°C)	Harzburgite	Lherzolite	Dunite	Serpentinization (%)*			
					20	40	60	80
37.5	350	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.2	360	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
42.8	370	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
45.0	380	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1
46.9	390	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1
48.4	400	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49.4	410	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.1	420	0.0	0.1	0.1	0.0	0.0	0.0	0.0
50.5	430	0.1	0.1	0.1	0.0	0.0	0.0	0.0
50.5	440	0.1	0.2	0.2	0.0	0.0	0.0	0.0
50.5	450	0.2	0.2	0.2	0.0	0.0	0.0	0.0
50.5	460	0.1	0.1	0.2	0.0	0.0	0.0	0.0
50.5	470	0.5	0.3	0.6	0.0	0.0	0.0	0.0
50.5	480	0.4	0.3	0.5	0.0	0.0	0.0	0.5
50.5	490	0.6	0.1	0.6	0.0	0.0	0.1	0.8
50.5	500	0.8	0.1	1.6	0.0	0.0	1.0	0.8
50.5	510	0.1	0.1	0.5	0.0	0.0	0.1	0.1
50.5	520	0.1	0.1	0.1	0.0	0.0	0.1	0.1
50.5	530	0.1	0.1	0.1	0.0	0.0	0.1	0.1
50.5	540	0.1	0.1	0.1	0.0	0.0	0.1	0.1
50.7	550	0.1	0.0	0.1	0.0	0.0	0.0	0.1
52.2	560	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.1
54.1	570	-0.1	-0.1	-0.2	0.0	0.0	-0.1	-0.1
56.4	580	-0.2	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1
59.2	590	-0.2	-0.2	-0.3	-0.1	-0.1	-0.1	-0.2
62.4	600	-0.3	-0.2	-0.3	-0.1	-0.1	-0.2	-0.2
66.1	610	-0.3	-0.2	-0.4	-0.1	-0.1	-0.2	-0.2
70.2	620	-0.3	-0.2	-0.4	-0.3	-0.2	-0.2	-0.3
74.7	630	-0.3	-0.3	-0.4	-0.1	-0.1	-0.2	-0.3
79.7	640	-0.4	-0.3	-0.4	-0.1	-0.1	-0.2	-0.3
85.1	650	-0.4	-0.3	-0.5	-0.1	-0.2	-0.2	-0.3
91.0	660	-0.4	-0.3	-0.5	-0.1	-0.2	-0.3	-0.3
97.3	670	-0.4	-0.3	-0.5	-0.2	-0.2	-0.2	-0.3
104.0	680	-0.5	-0.4	-0.5	-0.2	-0.2	-0.3	-0.4
111.2	690	-0.5	-0.4	-0.5	-0.2	-0.3	-0.4	-0.4
119.1	700	-0.5	-0.5	-0.5	-0.2	-0.3	-0.4	-0.5
127.5	710	-0.5	-0.5	-0.6	-0.2	-0.3	-0.4	-0.5
136.6	720	-0.6	-0.5	-0.6	-0.3	-0.3	-0.4	-0.5
146.7	730	-0.6	-1.4	-0.6	-0.3	-0.4	-0.4	-0.5
157.7	740	-0.8	-0.7	-0.6	-0.6	-0.7	-0.7	-0.8
170.0	750	-0.7	-0.6	-0.7	-0.3	-0.4	-0.5	-0.6

*Percent of water considered in the model for the harzburgite. See text for details.

Table S3. Volumetric evolution during subduction of the wet ultramafic portion of the Cocos oceanic lithospheric mantle.

Table S4. Density evolution during subduction of the wet ultramafic portion of the Cocos oceanic lithospheric mantle.

Depth (km)	Temperature (°C)	Harzburgite	Lherzolite	Dunite	Serpentinization (%)*			
					20	40	60	80
37.5	350	2683	2716	2710	3144	3026	2895	2787
40.2	360	2688	2721	2717	3146	3028	2898	2790
42.8	370	2693	2727	2723	3148	3030	2900	2793
45.0	380	2698	2731	2727	3149	3032	2902	2795
46.9	390	2702	2737	2734	3150	3033	2904	2796
48.4	400	2707	2742	2740	3150	3034	2905	2798
49.4	410	2712	2748	2747	3150	3034	2905	2798
50.1	420	2720	2756	2758	3150	3034	2905	2798
50.5	430	2725	2762	2765	3150	3033	2904	2798
50.5	440	2738	2777	2786	3149	3032	2904	2797
50.5	450	2752	2791	2807	3148	3032	2903	2796
50.5	460	2763	2803	2824	3147	3031	2902	2795
50.5	470	2814	2834	2888	3146	3030	2901	2794
50.5	480	2854	2860	2939	3145	3029	2900	2844
50.5	490	2920	2859	3009	3144	3028	2904	2927
50.5	500	3017	2859	3246	3143	3027	3017	3017
50.5	510	3016	2858	3322	3142	3026	3016	3016
50.5	520	3015	2858	3320	3141	3025	3015	3015
50.5	530	3014	2857	3319	3140	3024	3014	3014
50.5	540	3013	2857	3318	3139	3023	3013	3013
50.7	550	3013	2856	3317	3138	3022	3013	3013
52.2	560	3013	2857	3317	3138	3023	3013	3013
54.1	570	3015	2859	3318	3139	3024	3015	3015
56.4	580	3016	2861	3319	3147	3026	3016	3016
59.2	590	3019	2864	3320	3149	3028	3019	3019
62.4	600	3021	2867	3321	3151	3031	3021	3021
66.1	610	3024	2871	3323	3153	3034	3025	3025
70.2	620	3028	2876	3325	3164	3039	3028	3028
74.7	630	3032	2880	3328	3168	3043	3032	3032
79.7	640	3037	2886	3331	3172	3048	3037	3037
85.1	650	3042	2934	3334	3176	3053	3042	3042
91.0	660	3049	3022	3338	3180	3058	3049	3049
97.3	670	3125	3166	3342	3185	3127	3125	3125
104.0	680	3278	3232	3347	3278	3278	3278	3278
111.2	690	3313	3237	3362	3313	3313	3313	3313
119.1	700	3318	3243	3368	3318	3319	3318	3319
127.5	710	3324	3250	3374	3324	3324	3324	3324
136.6	720	3331	3257	3383	3331	3331	3331	3331
146.7	730	3338	3413	3394	3338	3338	3338	3338
157.7	740	3384	3434	3404	3384	3384	3384	3384
170.0	750	3392	3442	3418	3392	3392	3392	3392

*Percent of water considered in the model for the harzburgite. See text for details.

Table S4. Density evolution during subduction of the wet ultramafic portion of the Cocos oceanic lithospheric mantle.

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