Supplementary Information to Albers et al.: ‘Fluid–rock interactions in the shallow Mariana forearc: carbon cycling and redox conditions’

Figures

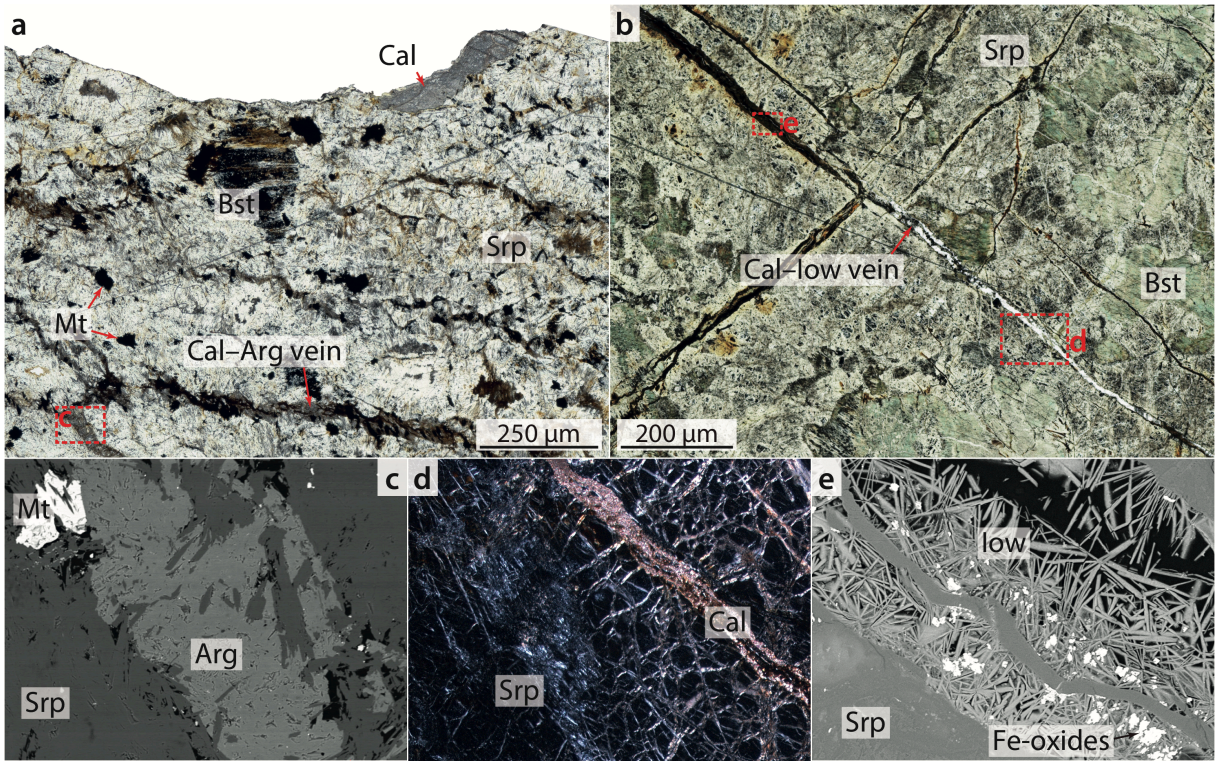

Figure S1: Carbonate phases in serpentinite clasts. Thin section scans of (a) a serpentinized dunite from Asùt Tesoru with calcite and aragonite veins (sample U1495B-5G-CC, 1–3 cm) and (b) a serpentinized harzburgite from Yinazao crosscut by a narrow calcite–iowaite vein (sample U1492C-1H-2, 18–20cm). Red rectangles mark positions of close-ups shown in lower panels. (c) SEM image of blocky aragonite. (d,e) Photomicrograph of calcite and SEM image of acicular iowaite occurring within the same vein. Abbreviations: Arg, aragonite; Bst, bastite; Cal, calcite; Iow, iowaite; Mt, magnetite.

Tables

Table S1: Representative geochemistry of metamorphic phases.

Sample	U1498B-8R-1, 32–34 cm	U1495B-5G-CC, 1–3 cm	U1497A-12F-1, 93–95 cm	U1498B-8R-1, 32–34 cm	U1496B-8X-CC, 33–41 cm	U1496B-10F-2, 10–12 cm	U1496B-8X-CC, 33–41 cm	U1496B-8X-CC, 33–41 cm	U1498B-8R-1, 32–34 cm	U1496A-10G-CC, 23–26 cm	U1497A-12F-1, 93–95 cm	U1496B-8X-CC, 33–41 cm	U1498B-8R-1, 10–15 cm	U1496A-10G-CC, 23–26 cm	U1498B-8R-1, 0–4 cm	U1498B-8R-1, 32–34 cm
Seamount	Fantang-isña	Asùt Tesoru	Fantang-isña	Fantang-isña	Asùt Tesoru	Asùt Tesoru	Asùt Tesoru	Asùt Tesoru	Fantang-isña	Asùt Tesoru	Fantang-isña	Asùt Tesoru	Fantang-isña	Asùt Tesoru	Fantang-isña	Fantang-isña
Phase	Chl	Chl	Cpx	Cpx	Gln	Gln	Lws	Lws	Pct	Pct	Ph	Ph	Pmp	Pmp	Prh	Prh
wt.%																
SiO_2	30.68	32.90	46.49	45.83	53.30	52.54	38.10	38.27	53.07	53.36	52.27	54.42	34.10	35.91	42.32	42.61
TiO_2	0.01	0.04	2.66	1.98	0.08	0.43	0.14	0.20	0.05	<0.01	0.53	0.06	0.44	0.15	0.01	0.21
Al_2O_3	14.88	15.06	6.73	4.91	4.86	4.89	32.14	31.97	<0.01	0.06	17.02	20.61	21.51	22.49	24.36	24.49
Cr_2O_3	0.25	0.62	0.05	0.10	0.02	0.01	0.03	0.03	<0.01	0.02	<0.01	0.01	0.08	0.05	0.02	0.03
MgO	19.82	34.23	13.33	9.84	1.41	2.94	0.02	0.03	0.02	0.01	6.25	5.14	2.63	7.49	0.00	0.10
FeO	19.80	3.62	8.22	16.00	22.58	17.98	1.11	1.54	0.33	0.07	10.07	3.87	6.39	6.30	0.08	0.38
MnO	0.17	<0.01	0.11	0.25	0.15	1.35	0.04	0.01	1.10	0.08	0.11	0.07	0.10	0.03	0.00	0.03
CaO	0.92	0.06	22.13	19.18	2.91	5.07	16.52	16.61	32.36	33.41	0.69	0.12	20.76	17.39	25.37	26.46
Na_2O	0.19	0.11	0.50	0.51	10.71	9.53	0.02	<0.01	8.23	8.14	0.52	0.19	0.28	0.54	0.08	0.08
K_2O	0.02	0.02	0.01	0.01	0.06	0.34	0.09	0.14	<0.01	<0.01	7.54	10.48	0.01	0.10	<0.01	<0.01
Total	86.74	86.66	100.22	98.62	96.06	95.08	88.21	88.77	95.14	95.15	94.99	94.96	86.30	90.44	92.24	94.38
Cations pfu																
Si	3.172	3.123	1.744	1.800	8.173	8.065	2.005	2.006	3.006	3.010	3.609	3.665	2.947	2.920	3.002	2.970
Ti	0.001	0.003	0.075	0.059	0.009	0.049	0.005	0.008	0.002	0.000	0.028	0.003	0.029	0.009	0.001	0.011
Al	1.813	1.685	0.298	0.227	0.878	0.885	1.993	1.975	0.000	0.004	1.385	1.636	2.191	2.156	2.036	2.012
Cr	0.021	0.047	0.001	0.003	0.002	0.001	0.001	0.001	0.000	0.001	0.000	0.001	0.005	0.003	0.001	0.002
Mg	3.055	4.846	0.745	0.576	0.321	0.672	0.001	0.002	0.001	0.001	0.643	0.516	0.339	0.908	0.000	0.010
Fe	1.712	0.287	0.258	0.526	2.895	2.308	0.049	0.068	0.015	0.003	0.582	0.218	0.462	0.428	0.004	0.022
Mn	0.015	0.000	0.003	0.008	0.019	0.176	0.002	0.000	0.053	0.004	0.006	0.004	0.007	0.002	0.000	0.002
Ni	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000
Ca	0.102	0.006	0.889	0.807	0.479	0.834	0.932	0.933	1.964	2.019	0.051	0.009	1.922	1.515	1.928	1.976
Na	0.038	0.020	0.036	0.039	3.184	2.836	0.002	0.000	0.904	0.890	0.069	0.025	0.047	0.085	0.011	0.010
K	0.003	0.002	0.000	0.001	0.011	0.067	0.006	0.009	0.000	0.000	0.664	0.900	0.001	0.010	0.000	0.000
Sum	9.931	10.019	4.050	4.046	15.976	15.894	4.997	5.002	5.944	5.933	7.037	6.976	7.950	8.039	6.984	7.017

Note. Cations pfu calculated on the basis of 6 O for Cpx, 14 O for Chl, 11 O for Prh, 12 O for Pmp, 11 O for Ph, 8 O for Lws, 23 O for Gln.

Abbreviations: Chl, chlorite; Cpx, clinopyroxene; Gln, glaucophane; Lws, lawsonite; pfu, per formula unit; Ph, phengite; Pmp, pumpellyite; Prh, prehnite.

Table S2: Pore water Sr concentrations and isotopic compositions.

Sample	Seamount	Depth [m bsf][a]	Sr [nM]	$^{87}Sr/^{86}Sr$
U1492C-1H-2	Yinazao	0.0	536	0.70598
U1492C-1H-4	Yinazao	0.0	660	0.70584
U1492C-3F-1	Yinazao	7.0	688	0.70566
U1492C-3F-2	Yinazao	7.0	687	0.70566
U1492C-5F-2	Yinazao	14.2	667	0.70568
U1492C-8F-2	Yinazao	28.2	679	0.70566
U1492C-11F-2	Yinazao	37.6	681	0.70567
U1492C-12F-1	Yinazao	42.3	688	0.70569
U1492C-13F-1	Yinazao	47.0	687	0.70567
U1492C-16F-1	Yinazao	61.1	503	0.70594
U1492C-19F-2	Yinazao	75.2	613	0.70569
U1492C-22F-1	Yinazao	89.3	741	0.70567
U1492C-24F-2	Yinazao	98.7	738	0.70567
U1492C-26F-1	Yinazao	108.1	729	0.70566
U1492C-27F-1	Yinazao	112.8	746	0.70567
U1497A-2F-2	Fantangisña	0.9	265	0.70585
U1497A-6F-1	Fantangisña	16.7	629	0.70495
U1497B-3F-2	Fantangisña	8.4	336	0.70573
U1497B-6F-1	Fantangisña	17.8	584	0.70507
U1496A-2F-1	Asùt Tesoru	3.2	15.4	0.70514
U1496A-3F-4	Asùt Tesoru	7.9	20.1	0.70515
U1496A-6F-3	Asùt Tesoru	22.0	16.8	0.70516
U1496A-9F-1	Asùt Tesoru	36.1	19.9	0.70527
U1496B-2F-1	Asùt Tesoru	1.9	9.3	0.70588
U1496B-3F-2	Asùt Tesoru	6.6	11	0.70526
U1496B-3F-5	Asùt Tesoru	6.6	12.4	0.70517
U1496B-5F-2	Asùt Tesoru	16.0	10.4	0.70510
U1496C-12G-3	Asùt Tesoru	98.8	21	0.70576
U1496C-13G-3	Asùt Tesoru	102.5	21.7	0.70549
U1496C-WSTP[b]	Asùt Tesoru	42.0	86.5	0.70675

Note. [a] Given depths are tops of individual cores.

[b] WSTP is water-sampling temperature probe; the sample was collected 9.5 days after circulation of drilling fluids had ceased in the bore hole; see Fryer et al. (2018d).