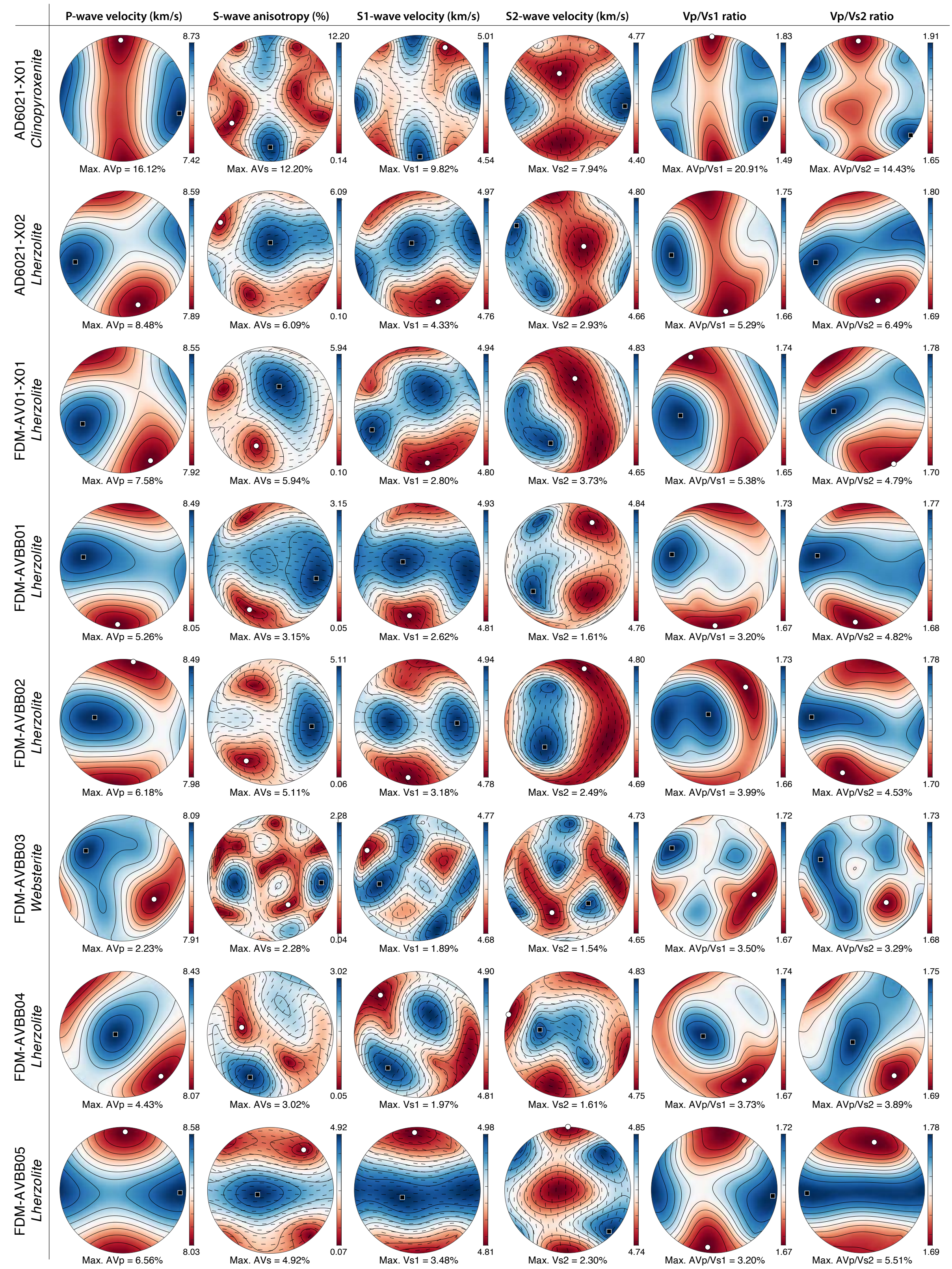

Figure S4. Calculated seismic properties of individual xenoliths from Marie Byrd Land, West Antarctica. From left to right are: the 3-D distributions of P-wave velocities (Vp), S-wave polarization anisotropy (AVs) and the orientation of fast shear wave polarization planea, S1 wave velocities (Vs1) and the orientation of fast shear wave polarization planes, S2 wave velocities (Vs2) and the orientation of slow shear wave polarization planes, Vp/Vs1 ratio, and Vp/Vs2 ratio. Black squares and white circles indicate maximum and minimum values, respectively. All plots are lower hemisphere equal area stereographic projections, displayed in the xenolith shape fabric reference framework, as shown in Figure S2.

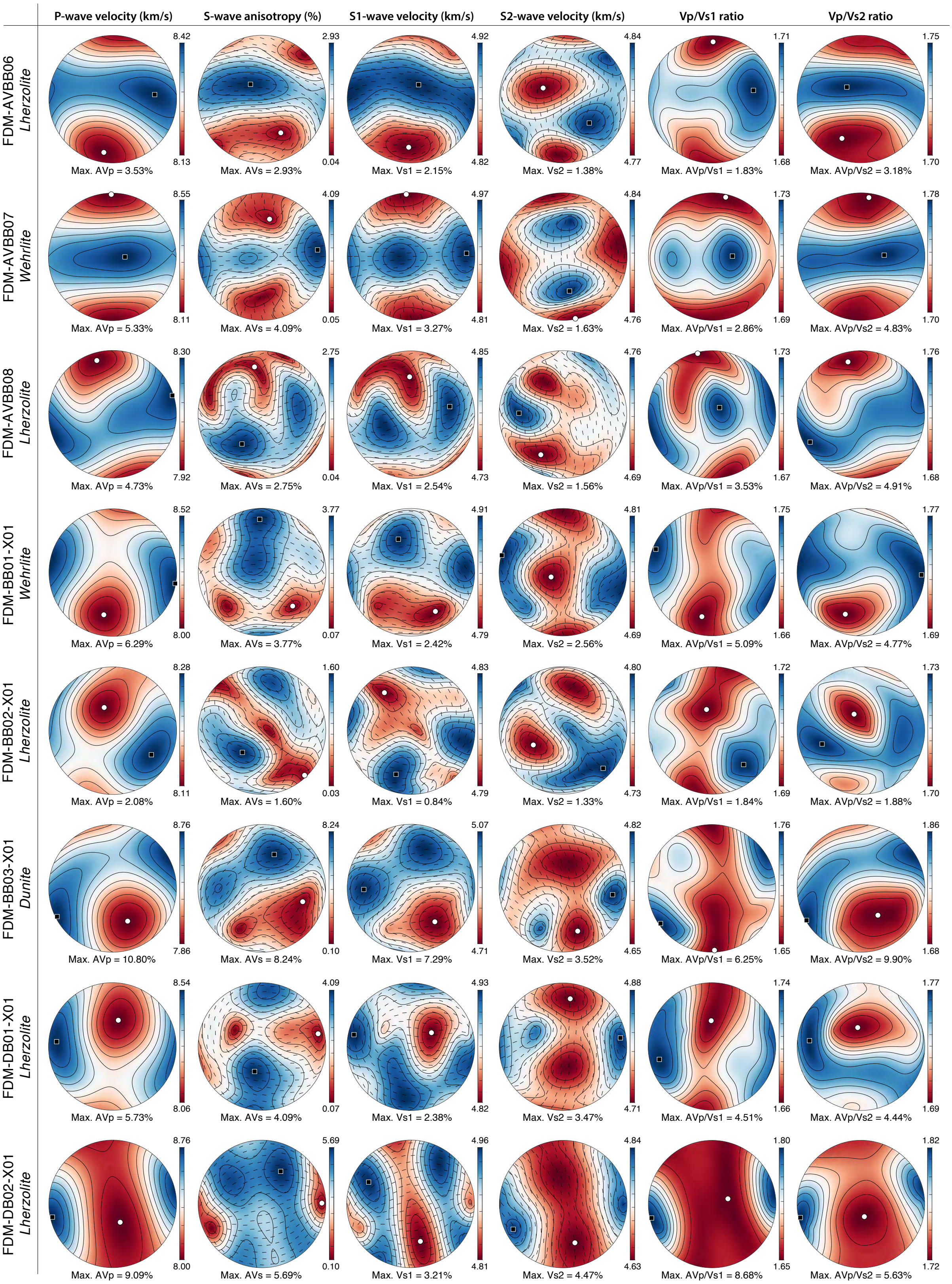

Figure S4. (continued)

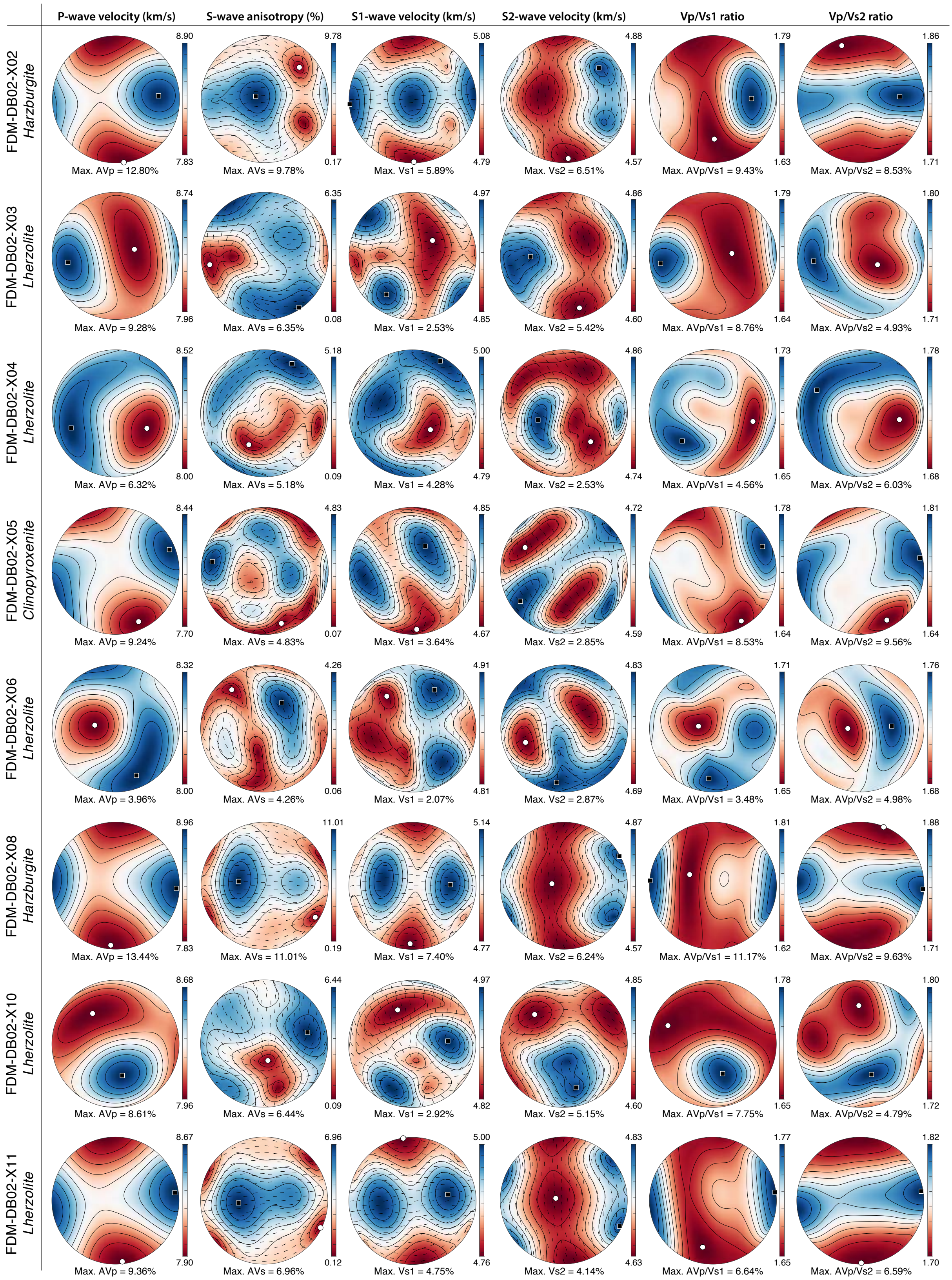

Figure S4. (continued)

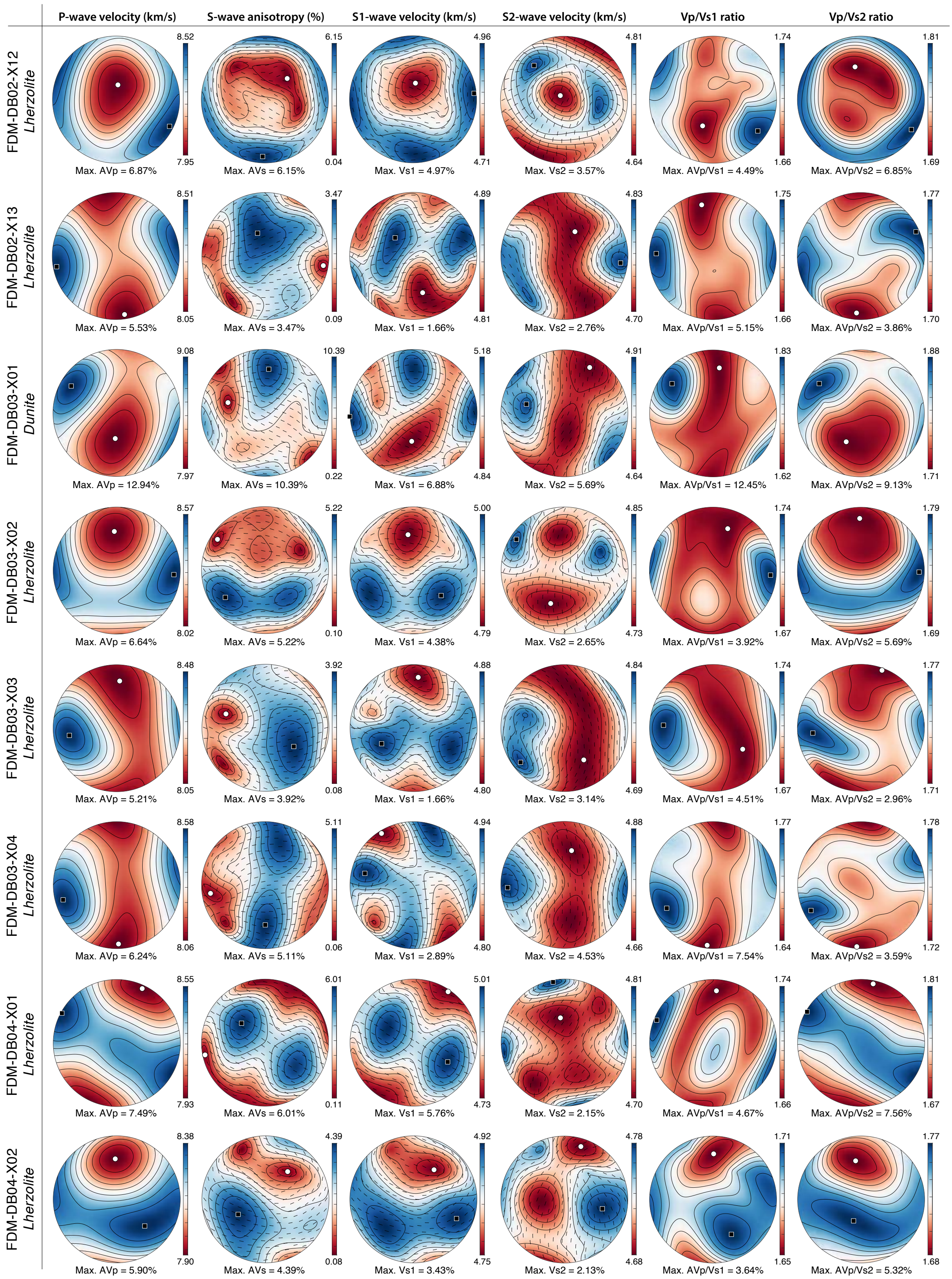

Figure S4. (continued)

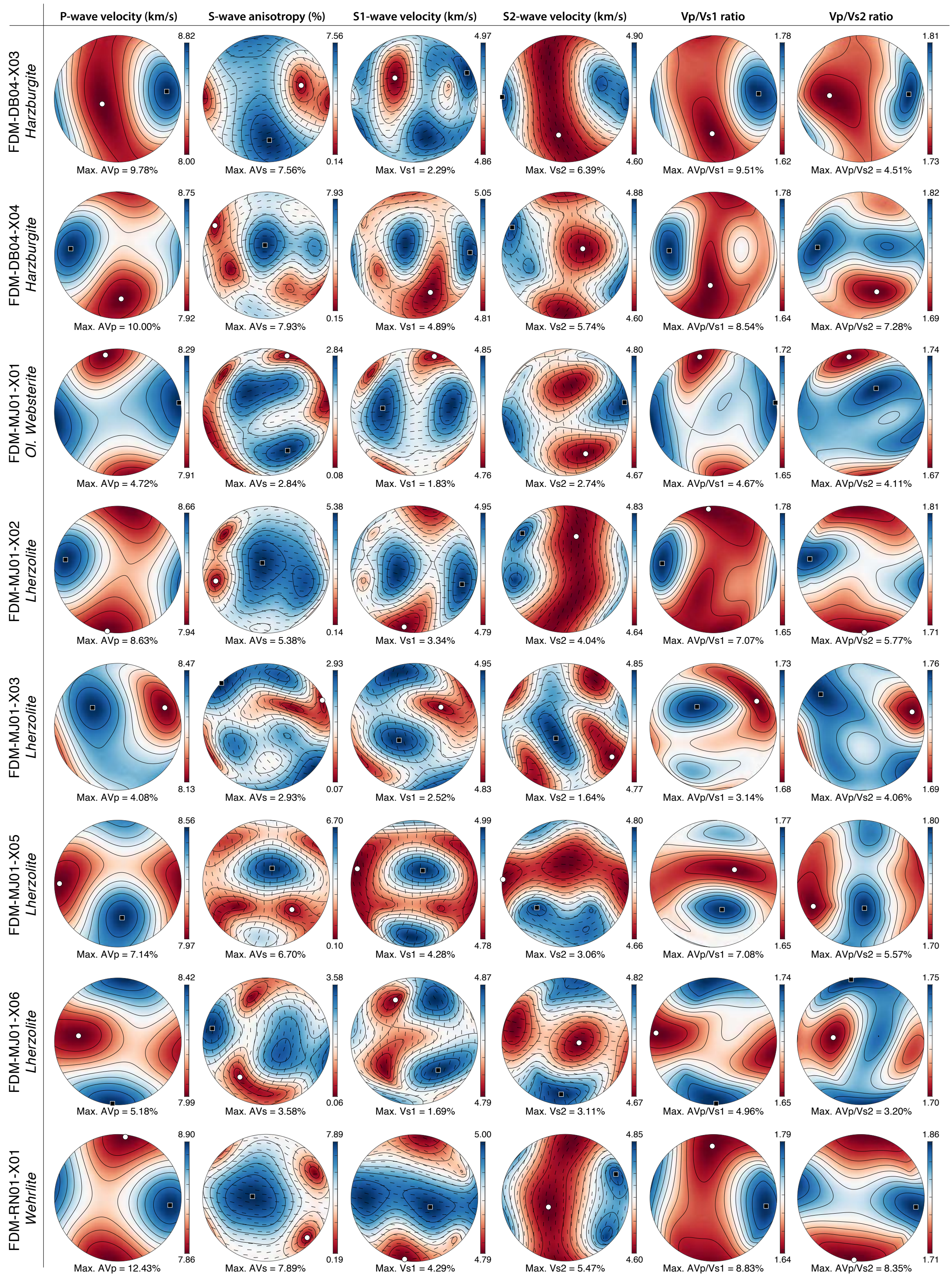

Figure S4. (continued)

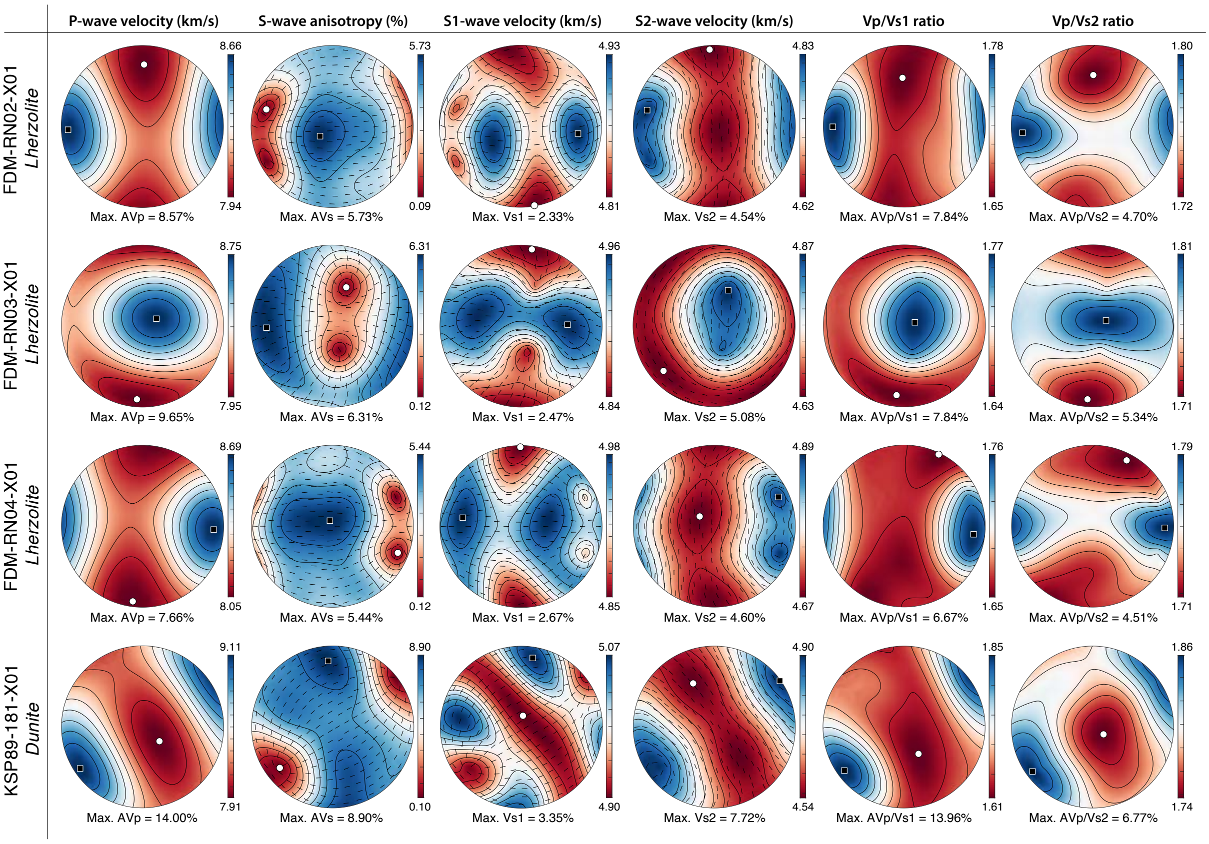

Figure S4. (continued)

2. Tables

Table S1. Geographic coordinates of the volcanic centers from which xenoliths were sampled.

Volcanic center	Latitude (S)	Longitude (W)
Fosdick Mountains		
Mount Avers	76.481°	145.396°
Bird Bluff	76.504°	144.598°
Demas Bluff	76.568°	144.853°
Marujupu	76.508°	145.670°
Recess Nunatak	76.519°	144.507°
Usas Escarpment		
Mount Aldaz	76.051°	124.417°
Executive Committee Range		
Mount Cumming	76.667°	125.820°

Table S2. Mineral major element composition

Xenolith	Olivine Mg# Average (Min / Max)	Orthopyroxene Al_2O_3 Average (Min / Max)	Orthopyroxene MgO Average (Min / Max	Clinopyroxene TiO_2 Average (Min / Max)	Clinopyroxene Al_2O_3 Average (Min / Max)	Clinopyroxene MgO Average (Min / Max)	Clinopyroxene Cr_2O_3 Average (Min / Max)	Clinopyroxene Na_2O Average (Min / Max)	Spinel Cr# Average
Mount Avers									
FDM-AV01-X01	90.07 (89.67 / 90.47)	4.24 (3.60 / 4.77)	33.03 (32.59 / 33.42)	0.62 (0.53 / 0.70)	7.54 (6.76 / 7.92)	14.03 (13.70 / 14.65)	1.09 (1.00 / 1.22)	1.94 (1.81 / 2.11)	13
Bird Bluff									
FDM-BB01-X01	88.19 (87.87 / 88.50)	3.93 (3.22 / 4.42)	32.89 (32.59 / 33.37)	0.47 (0.41 / 0.52)	5.70 (4.92 / 6.35)	15.02 (14.67 / 15.49)	0.80 (0.63 / 0.95)	1.29 (1.12 / 1.57)	12
FDM-BB02-X01	88.15 (87.98 / 88.57)	4.57 (4.31 / 4.95)	32.60 (32.14 / 32.98)	0.64 (0.50 / 0.73)	7.26 (6.90 / 7.54)	14.84 (14.63 / 15.06)	0.65 (0.57 / 0.72)	1.88 (1.69 / 1.99)	8
FDM-BB03-X01	91.18 (90.70 / 91.52)	3.40 (3.36 / 3.47)	34.22 (33.80 / 34.55)	0.13 (0.07 / 0.21)	5.04 (4.83 / 5.21)	14.96 (14.83 / 15.08)	1.76 (1.60 / 1.85)	1.90 (1.71 / 2.04)	33
Demas Bluff									
FDM-DB01-X01	89.36 (88.91 / 89.81)	4.69 (4.25 / 4.92)	32.95 (32.35 / 33.30)	0.65 (0.56 / 0.71)	7.62 (7.47 / 7.77)	14.53 (14.06 / 14.74)	0.77 (0.66 / 0.84)	2.09 (1.88 / 2.25)	8
FDM-DB02-X01	90.51 (90.16 / 90.81)	5.84 (5.75 / 5.95)	32.28 (31.90 / 32.49)	0.27 (0.23 / 0.34)	6.90 (6.71 / 7.05)	17.17 (16.89 / 17.38)	1.02 (0.84 / 1.18)	1.17 (1.05 / 1.26)	16
FDM-DB02-X02	91.53 (91.17 / 92.02)	1.86 (1.77 / 1.93)	35.12 (34.84 / 35.43)	0.03 (0.00 / 0.07)	1.80 (1.73 / 1.98)	17.87 (17.68 / 18.17)	0.77 (0.68 / 0.87)	0.30 (0.24 / 0.34)	52
FDM-DB02-X03	90.22 (89.94 / 90.87)	5.18 (5.09 / 5.29)	33.17 (32.86 / 33.38)	0.52 (0.43 / 0.57)	6.82 (6.69 / 7.00)	14.99 (14.71 / 15.27)	0.83 (0.76 / 0.89)	1.75 (1.66 / 1.86)	10
FDM-DB02-X04	90.09 (89.86 / 90.32)	4.21 (3.48 / 4.72)	33.15 (32.04 / 34.18)	0.57 (0.48 / 0.65)	5.85 (4.62 / 6.83)	14.66 (14.29 / 16.54)	0.98 (0.34 / 1.43)	1.33 (0.07 / 2.15)	16
FDM-DB02-X05	--	4.96 (4.51 / 5.93)	29.95 (29.39 / 30.44)	0.50 (0.40 / 0.58)	7.65 (6.55 / 8.18)	14.40 (14.08 / 15.15)	0.10 (0.01 / 0.19)	1.28 (1.22 / 1.40)	1
FDM-DB02-X06	83.37 (83.16 / 83.61)	6.10 (5.24 / 6.89)	29.06 (28.64 / 29.64)	0.78 (0.56 / 0.99)	7.59 (6.83 / 8.33)	16.48 (15.82 / 17.24)	0.06 (0.02 / 0.10)	1.29 (1.08 / 1.40)	--
FDM-DB02-X08	91.80 (91.47 / 92.05)	2.45 (2.11 / 2.76)	35.08 (34.62 / 35.51)	0.04 (0.00 / 0.11)	2.69 (2.32 / 2.98)	17.16 (16.92 / 17.53)	0.20 (0.12 / 0.26)	0.64 (0.57 / 0.76)	37
FDM-DB02-X10	89.84 (89.47 / 90.20)	5.07 (4.86 / 5.20)	32.72 (32.41 / 33.08)	0.60 (0.53 / 0.66)	6.91 (6.63 / 7.23)	14.94 (14.56 / 15.50)	0.89 (0.70 / 1.04)	1.95 (1.79 / 2.15)	11
FDM-DB02-X11	90.59 (90.32 / 91.02)	4.09 (3.77 / 4.56)	33.92 (33.51 / 34.44)	0.34 (0.26 / 0.41)	6.34 (6.06 / 6.72)	15.36 (14.99 / 15.65)	1.20 (1.09 / 1.33)	1.64 (1.57 / 1.70)	17
FDM-DB02-X12	90.00 (89.45 / 90.41)	4.84 (4.69 / 5.01)	33.17 (32.88 / 33.32)	0.55 (0.42 / 0.62)	7.06 (6.75 / 7.31)	15.04 (14.76 / 15.70)	0.87 (0.72 / 0.96)	1.96 (1.86 / 2.07)	11
FDM-DB02-X13	89.39 (88.93 / 89.75)	5.08 (4.90 / 5.35)	32.69 (31.94 / 33.15)	0.79 (0.76 / 0.86)	7.89 (7.64 / 8.08)	13.98 (13.86 / 14.12)	0.79 (0.71 / 0.88)	2.07 (1.95 / 2.16)	9
FDM-DB03-X01	91.70 (91.40 / 91.91)	2.44 (2.28 / 2.59)	34.99 (34.76 / 35.47)	0.01 (0.00 / 0.03)	2.25 (1.82 / 2.58)	17.46 (17.12 / 17.86)	0.15 (0.08 / 0.22)	0.46 (0.38 / 0.62)	33

FDM-DB03-X02	89.47 (88.96 / 89.80)	4.52 (3.91 / 5.04)	33.07 (32.51 / 33.40)	0.66 (0.55 / 0.73)	7.45 (7.25 / 7.64)	14.33 (14.06 / 14.54)	0.14 (0.10 / 0.20)	2.03 (1.93 / 2.25)	9
FDM-DB03-X03	89.67 (89.40 / 89.89)	4.87 (4.58 / 5.22)	33.53 (32.74 / 33.93)	0.63 (0.57 / 0.67)	7.37 (7.08 / 7.57)	14.57 (14.30 / 15.15)	0.79 (0.65 / 0.96)	1.94 (1.80 / 2.01)	9
FDM-DB03-X04	91.78 (91.32 / 92.14)	2.69 (2.58 / 2.80)	34.86 (34.46 / 35.14)	0.05 (0.02 / 0.09)	3.41 (3.10 / 3.65)	16.86 (16.61 / 17.19)	1.14 (0.98 / 1.29)	0.72 (0.66 / 0.80)	35
FDM-DB04-X01	91.14 (90.83 / 91.42)	3.43 (3.29 / 3.65)	33.87 (33.37 / 34.28)	0.50 (0.40 / 0.53)	5.77 (5.54 / 5.95)	14.90 (14.68 / 15.23)	1.62 (1.53 / 1.73)	2.03 (1.87 / 2.11)	9
FDM-DB04-X02	89.80 (89.42 / 90.28)	4.84 (4.49 / 5.02)	33.04 (32.58 / 33.27)	0.62 (0.55 / 0.66)	7.61 (7.17 / 7.99)	14.27 (14.09 / 14.56)	0.79 (0.66 / 0.93)	2.08 (1.91 – 2.21)	9
FDM-DB04-X03	91.92 (91.60 / 92.35)	2.61 (2.50 / 2.74)	34.74 (34.-2 / 35.10)	0.01 (0.00 / 0.04)	2.44 (2.30 / 2.68)	17.38 (17.20 / 17.52)	0.85 (0.75 / 1.05)	0.44 (0.34 / 0.62)	41
FDM-DB04-X04	90.10 (89.86 / 90.32)	2.75 (2.66 / 2.90)	34.84 (34.61 / 35.02)	0.57 (0.48 / 0.65)	2.90 (2.69 / 3.06)	17.01 (16.80 / 17.35)	1.06 (0.97 / 1.18)	0.73 (0.65 / 0.80)	37
Marujupu									
FDM-MJ01-X01	89.20 (88.94 / 89.67)	4.84 (4.27 / 5.18)	32.83 (32.24 / 33.21)	0.63 (0.51 / 0.71)	7.60 (6.98 / 8.00)	14.51 (14.19 / 14.86)	0.11 (0.04 / 0.15)	1.92 (1.68 / 2.12)	7
FDM-MJ01-X02	88.98 (88.20 / 89.67)	4.49 (4.09 / 5.18)	32.55 (31.56 / 33.35)	0.61 (0.54 / 0.70)	7.73 (7.41 / 8.07)	14.00 (13.55 / 14.54)	0.77 (0.51 / 1.05)	1.94 (1.74 / 2.10)	10
FDM-MJ01-X03	89.75 (89.05 / 90.35)	4.60 (4.24 / 5.22)	33.12 (32.67 / 33.43)	0.68 (0.58 / 0.73)	7.86 (7.68 / 8.04)	13.64 (13.42 / 13.78)	1.00 (0.92 / 1.10)	2.32 (2.20 / 2.45)	10
FDM-MJ01-X05	89.78 (89.28 / 90.29)	4.44 (4.33 / 4.59)	33.24 (32.84 / 33.52)	0.55 (0.47 / 0.59)	7.05 (6.91 / 7.28)	14.70 (14.46 / 14.89)	0.86 (0.80 / 0.91)	1.97 (1.84 / 2.08)	11
FDM-MJ01-X06	88.36 (87.77 / 89.06)	5.06 (4.43 / 5.67)	32.53 (32.18 / 32.82)	0.83 (0.43 / 0.90)	7.33 (7.00 / 7.85)	14.07 (13.82 / 14.99)	0.86 (0.72 / 1.09)	2.08 (1.70 / 2.32)	10
Recess Nunatak									
FDM-RN01-X01	91.64 (91.10 / 91.91)	3.26 (3.13 / 3.40)	34.18 (33.66 / 34.51)	0.24 (0.19 / 0.28)	5.18 (4.74 / 5.34)	15.21 (14.98 / 15.78)	1.41 (1.25 / 1.53)	1.50 (1.38 / 1.61)	25
FDM-RN02-X01	88.82 (88.35 / 89.25)	4.78 (4.47 / 5.10)	32.72 (31.65 / 33.09)	0.65 (0.59 / 0.73)	8.03 (7.71 / 8.46)	13.86 (13.58 / 14.35)	0.12 (0.05 / 0.17)	2.10 (1.96 / 2.29)	7
FDM-RN03-X01	90.96 (90.51 / 91.28)	3.77 (3.48 / 4.38)	33.68 (32.90 / 34.20)	0.48 (0.41 / 0.53)	6.10 (5.94 / 6.21)	14.84 (14.59 / 15.14)	1.45 (1.19 / 1.63)	2.13 (1.93 / 2.54)	24
FDM-RN04-X01	89.12 (88.65 / 89.49)	4.86 (4.37 / 5.28)	32.98 (32.70 / 33.48)	0.64 (0.52 / 0.74)	8.13 (7.87 / 8.49)	13.89 (13.58 / 14.19)	0.11 (0.05 / 0.16)	2.12 (1.97 / 2.35)	6
Mount Avers – Bird Bluff									
FDM-AVBB01	89.57 (88.80 / 89.82)	4.62 (4.27 / 5.00)	33.04 (32.54 / 33.77)	0.58 (0.45 / 0.66)	7.11 (6.71 / 7.34)	14.91 (14.60 / 15.32)	0.45 (0.05 / 0.90)	2.00 (1.74 / 2.34)	9
FDM-AVBB02	90.20 89.62 / 90.59	4.85 (3.97 / 5.48)	33.03 (32.43 / 33.80)	0.56 (0.36 / 0.62)	7.32 (6.07 / 8.02)	14.30 (13.74 / 15.15)	0.41 (0.08 / 1.11)	1.87 (1.59 / 2.14)	10
FDM-AVBB03	--	6.16 (5.71 / 6.55)	32.44 (31.95 / 32.96)	0.22 (0.18 / 0.30)	8.50 (7.96 / 8.90)	14.05 (13.74 / 14.43)	0.26 (0.13 / 0.40)	1.73 (1.65 / 1.85)	3
FDM-AVBB04	89.45 (89.15 / 89.63)	5.10 (4.59 / 5.67)	32.68 (32.14 / 33.13)	0.52 (0.46 / 0.58)	7.95 (7.64 / 8.29)	14.25 (13.80 / 15.91)	0.61 (0.49 / 0.78)	1.93 (1.74 / 2.04)	6
FDM-AVBB05	90.13 (89.27 / 90.45)	4.97 (3.83 / 6.07)	32.93 (30.43 / 34.19)	0.63 (0.54 / 0.78)	7.86 (7.00 / 8.50)	14.16 (13.64 / 16.35)	0.38 (0.01 / 0.92)	1.89 (1.56 / 2.07)	8

FDM-AVBB06	*88.72 (88.43 / 89.05)*	*5.02 (4.29 / 5.76)*	*32.39 (31.85 / 32.96)*	*0.55 (0.51 / 0.62)*	*7.75 (7.50 / 8.12)*	*14.23 (13.77 / 15.21)*	*0.73 (0.55 / 0.89)*	*2.01 (1.80 / 2.15)*	*8*
FDM-AVBB07	*89.41 (88.97 / 89.58)*	*4.33 (3.85 / 4.77)*	*32.82 (31.47 / 33.49)*	*0.58 (0.52 / 0.62)*	*7.52 (6.97 / 8.00)*	*14.34 (13.69 / 16.12)*	*0.78 (0.62 / 0.93)*	*1.96 (1.74 / 2.14)*	*9*
FDM-AVBB08	*89.96 (89.71 / 90.30)*	*5.23 (4.52 / 5.56)*	*33.04 (32.34 / 33.85)*	*0.56 (0.49 / 0.61)*	*8.03 (7.74 / 8.32)*	*14.23 (13.76 / 15.57)*	*0.85 (0.68 / 1.01)*	*1.96 (1.87 / 2.09)*	*8*
Mount Aldaz									
AD6021-X01	*90.60 (90.19 / 91.08)*	*4.80 (4.17 / 5.46)*	*33.33 (32.88 / 33.70)*	*0.22 (0.17 / 0.28)*	*5.74 (5.10 / 6.67)*	*16.24 (15.93 / 16.49)*	*0.67 (0.23 / 1.04)*	*1.11 (0.98 / 1.25)*	*9 / 22 / 29*
AD6021-X02	*89.73 (89.35 / 90.14)*	*4.78 (4.62 / 4.96)*	*32.96 (32.57 / 33.33)*	*0.51 (0.45 / 0.56)*	*6.80 (6.62 / 7.02)*	*15.58 (15.25 / 15.81)*	*0.72 (0.67 / 0.78)*	*1.62 (1.47 / 1.82)*	*10*
Mount Cumming									
KSP89-181-X01	*89.39 (88.95 / 89.95)*	--	--	--	--	--	--	--	*51 / 63*

Table S3. Synthetic seismic properties by modal composition for all Fosdick Mountains xenoliths, and xenoliths with orthorhombic, axial-[010], and axial-[100] CPO symmetries.

	Modal Composition	*Vp Max Velocity (km/sec)*	*Vp Anisotropy (%)*	*Vs1 Max Velocity (km/sec)*	*Vs2 Max Velocity (km/sec*	*Vs Anisotropy (%)*	*Vp/Vs1 Anisotropy (%)*	*Vp/Vs2 Anisotropy (%)*
Fosdick Mountains	$Ol_{100}Opx_0Cpx_0$	8.71	8.73	4.98	4.84	6.03	5.33	6.66
	$Ol_{80}Opx_{10}Cpx_{10}$	8.49	5.00	4.89	4.81	3.11	3.41	3.70
	$Ol_{60}Opx_{20}Cpx_{20}$	8.41	4.40	4.86	4.80	2.50	3.26	3.17
	$Ol_{40}Opx_{30}Cpx_{30}$	8.33	3.83	4.83	4.79	2.10	3.14	2.60
	$Ol_{20}Opx_{40}Cpx_{40}$	8.25	3.34	4.80	4.77	1.84	3.05	2.08
	$Ol_0Opx_{50}Cpx_{50}$	8.27	2.91	4.82	4.81	1.67	3.00	1.81
Orthorhombic A-Type	$Ol_{100}Opx_0Cpx_0$	8.71	8.73	4.98	4.84	6.04	5.33	6.67
	$Ol_{80}Opx_{10}Cpx_{10}$	8.54	6.70	4.92	4.82	4.65	4.13	5.05
	$Ol_{60}Opx_{20}Cpx_{20}$	8.50	6.13	4.91	4.81	4.24	3.78	4.59
	$Ol_{40}Opx_{30}Cpx_{30}$	8.46	5.68	4.90	4.81	3.92	3.55	4.22
	$Ol_{20}Opx_{40}Cpx_{40}$	8.37	4.54	4.87	4.79	3.13	3.00	3.35
	$Ol_0Opx_{50}Cpx_{50}$	8.26	3.30	4.85	4.82	2.46	3.08	3.04
Axial-[100]	$Ol_{100}Opx_0Cpx_0$	8.75	7.85	4.97	4.87	6.33	7.41	4.42
	$Ol_{80}Opx_{10}Cpx_{10}$	8.62	6.10	4.95	4.89	4.67	5.37	3.44
	$Ol_{60}Opx_{20}Cpx_{20}$	8.53	5.35	4.92	4.87	3.91	4.59	3.11
	$Ol_{40}Opx_{30}Cpx_{30}$	8.49	5.17	4.90	4.85	3.61	4.44	3.19
	$Ol_{20}Opx_{40}Cpx_{40}$	8.36	4.36	4.85	4.82	2.98	3.80	3.12
	$Ol_0Opx_{50}Cpx_{50}$	8.20	3.29	4.81	4.78	2.56	3.65	3.23
Axial-[010]	$Ol_{100}Opx_0Cpx_0$	8.56	4.85	4.91	4.83	2.81	3.66	3.43
	$Ol_{80}Opx_{10}Cpx_{10}$	8.46	4.28	4.87	4.81	2.42	3.34	3.02
	$Ol_{60}Opx_{20}Cpx_{20}$	8.37	3.74	4.84	4.80	2.06	3.06	2.61
	$Ol_{40}Opx_{30}Cpx_{30}$	8.28	3.19	4.81	4.78	1.74	2.74	2.29
	$Ol_{20}Opx_{40}Cpx_{40}$	8.20	2.80	4.78	4.77	1.46	2.64	2.19
	$Ol_0Opx_{50}Cpx_{50}$	8.31	2.54	4.86	4.85	1.16	2.77	2.27

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