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Auxiliary Material

Auxiliary material for this article contains Figures S1–S2 with profiles of data for several events and profiles of data sampling several of the bins. Table S1 lists event parameters, and a brief discussion of ULVZ attributes is included.

Auxiliary Material for Paper 2004JB003270

Shear velocity variation within the D" region beneath the central Pacific

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Introduction

This auxiliary material contains supplemental details to the published text.

1. 2004JB003270-ts01.txt is a list of events used in our final data set with the event parameters. Table S1. The final event set has magnitudes ranging from 5.7 to 7.6, all with favorable SH radiation to the broadband network and with successful removal of source wavelet complexity.

2. 2004JB03270-txts01.txt is additional text describing the background research conducted on the ULVZ.

3. 2004JB003270-fs01.eps contains data profiles of event data representative of our data set. Figure S1. Event profiles of transverse component displacement seismograms from March 31, 1994, October 6, 1995, December 18, 2000, and November 5, 2001 after source wavelet deconvolution and low-pass filtering. The March 31, 1994 and November

5, 2001 events show fairly consistent intermediate arrivals between S and ScS, but for events on October 6, 1995 and December 18, 2000, any such intermediate arrival is much less apparent (see Table S1 for event listing). For some events, such as November 5, 2001, consistent intermediate arrivals are apparent between S and ScS, whereas for other events, such as October 6, 1995, it is difficult to identify candidates for D" reflections.

4. 2004JB003270-fs02.eps contains data profiles bin data for bins C, D, G, and I. Figure S2. Composite data profiles for the combined traces stacked in Bins C, D, G and I. Waveforms from separate events and different source depths contribute to each stack, and for clarity of display, the traces are shifted in distance so that S and ScS align on the arrival times for a source at a depth of 600 km in the M1 model. The coherent arrivals between S and ScS that yield the strongest stacked SdS phases in Figure 5 can be observed clearly in Bins C, G, and I, although D2 and D3 features remain elusive in the individual traces.

5. 2004JB003270-txts02.txt is additional discussion of Figures S1 and S2.

References

Avants, M.S., T. Lay, and E.J. Garnero, Stacking ScS waveforms to determine ULVZ S-wave velocity structure beneath the central Pacific, Geophys. Res. Lett., submitted.

Lay, T., Q. Williams, and E.J. Garnero, The core-mantle boundary layer and deep Earth dynamics, Nature, 392, 461-468, 1998.

Lay, T., E.J. Garnero, and Q. Williams, Partial melting in a thermo-chemical boundary layer at the base of the mantle, Phys. Earth Planet. Inter., 146, 441-467, 2004.

Mori, J., and D.V. Helmberger, Localized boundary layer below the mid-Pacific velocity anomaly identified from a PcP precursor, J. Geophys. Res., 100(20), 359-20, 365, 1995.

Niu, F., and L. Wen, Strong seismic scatterers near the core-mantle boundary west of Mexico, Geophys. Res. Lett., 28(18), 3557-3560, 2001.

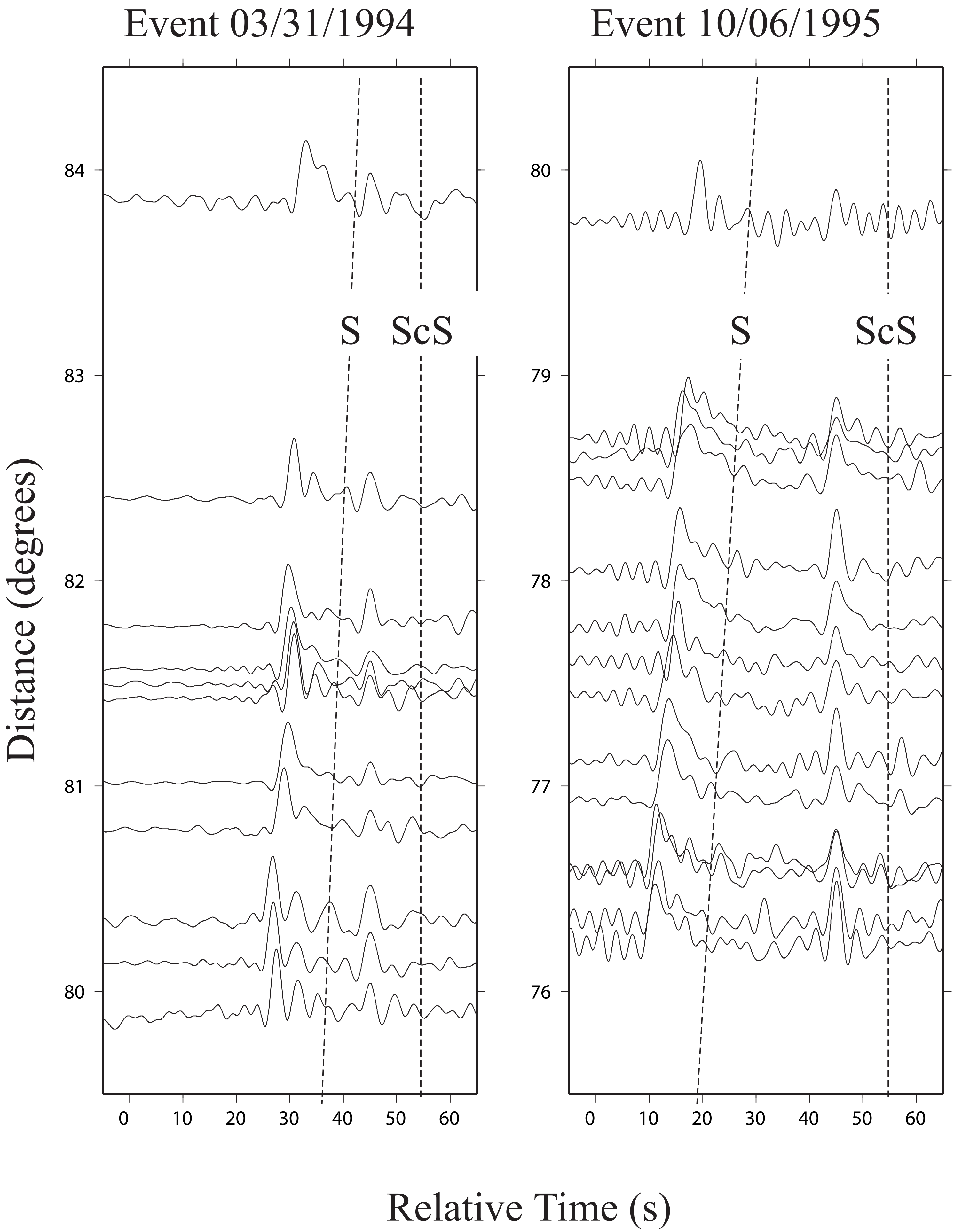
Rost, S., and J. Revenaugh, Small-scale ultralow-velocity zone structure imaged by ScP, J. Geophys. Res., 108(B1), 2056, doi:10.1029/2001JB001627, 2003.

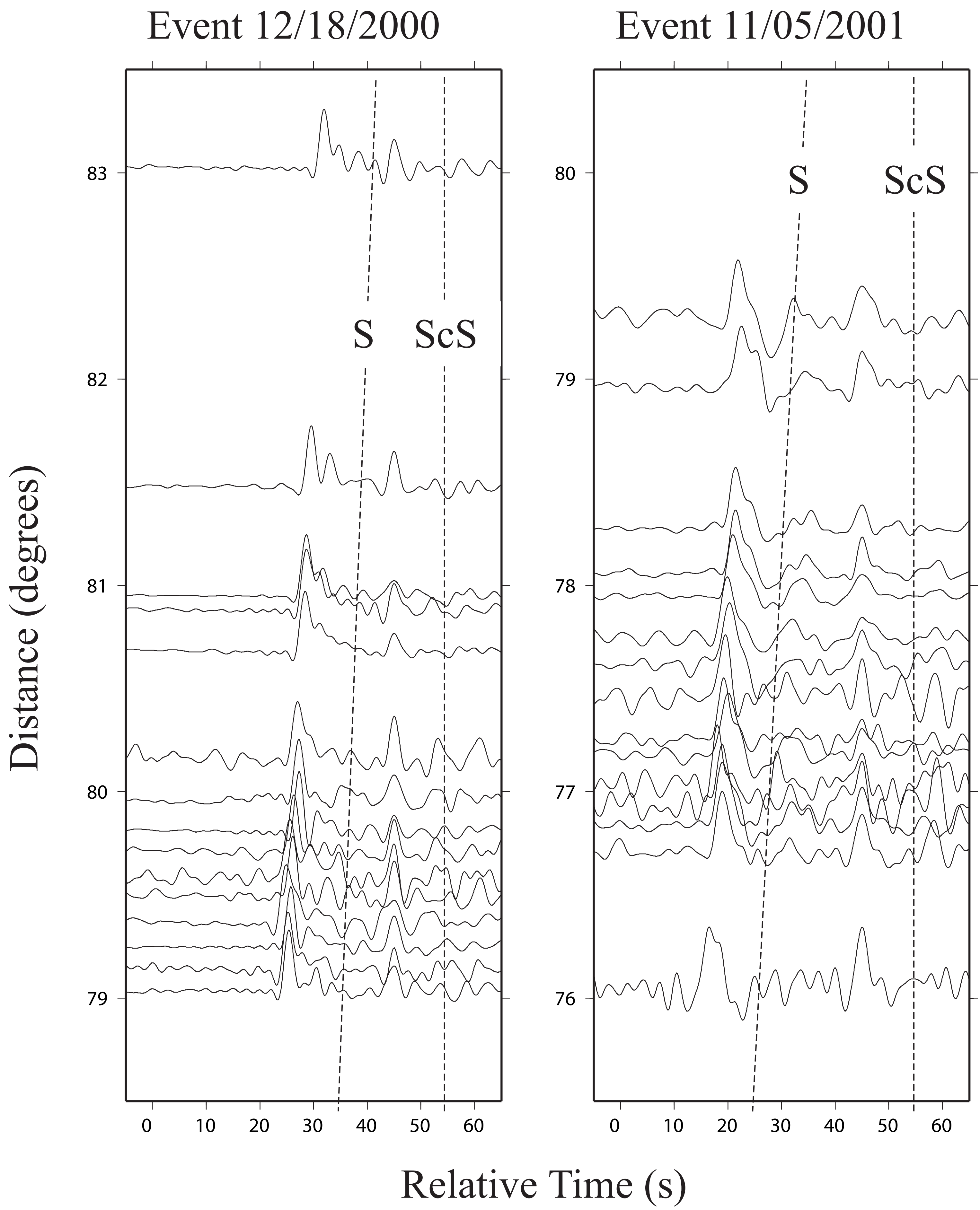
Thorne, M.S., and E.J. Garnero, Inferences on ultralow-velocity structure froma global analysis of SPdKS waves, J. Geophys. Res., 109, B08301, 2004.

Vidale, J.E., and M.A.H. Hedlin, Evidence for partial melt at the core-mantle boundary north of Tonga from the strong scattering of seismic waves, Nature, 391(6668), 682-685, 1998.

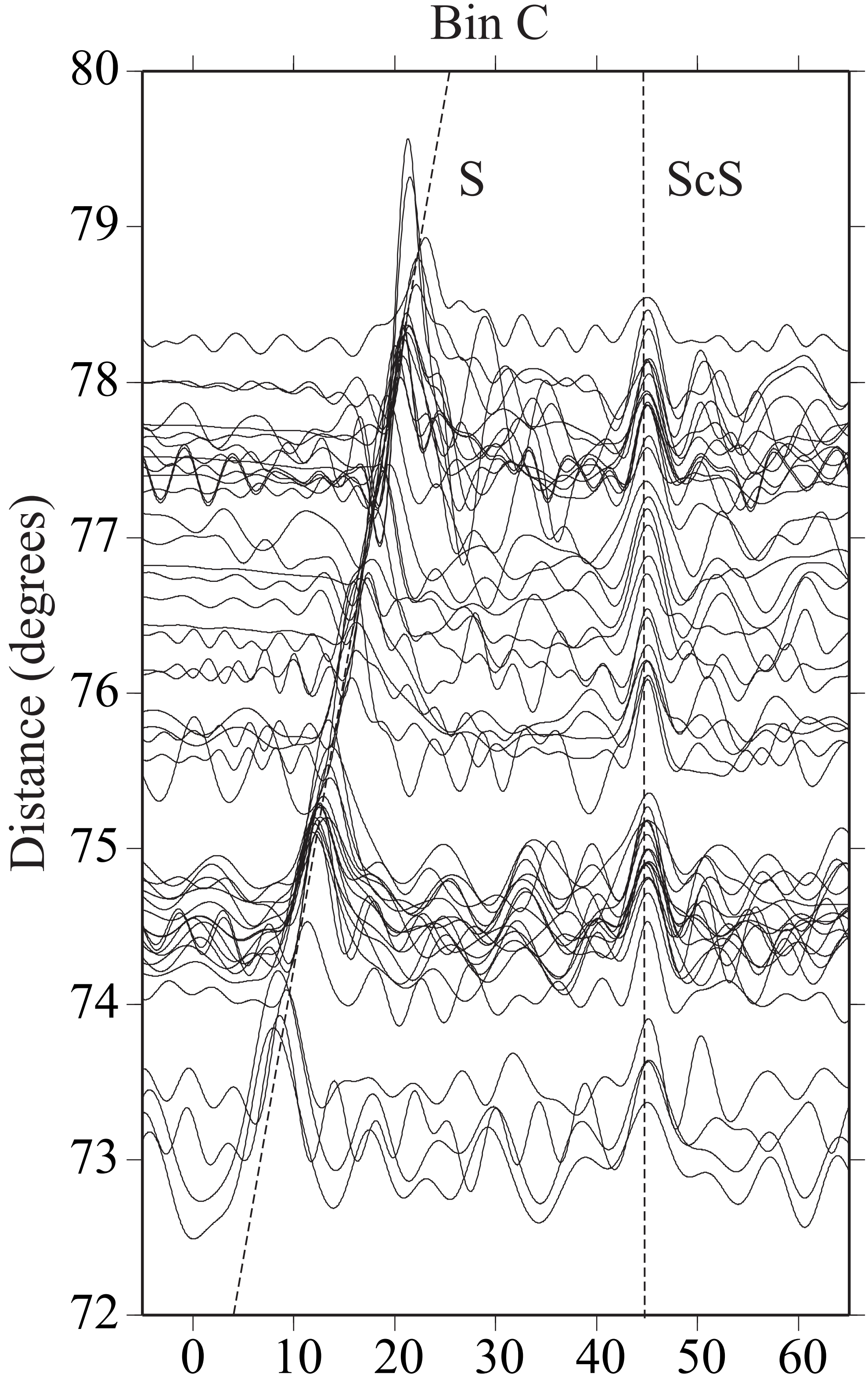
Williams, Q., and E.J. Garnero, Seismic evidence for partial melt at the base of the Earth's mantle, Science, 273, 1528-1530, 1996.

Additional ULVZ background: ULVZ structure to date has been determined mostly through the analysis of P and/or SV data. Mori and Helmberger [1995] first characterized the existence of anomalous mantle structure at the CMB beneath the Pacific by detecting precursors to PcP. Subsequent studies used precursors to PcP or ScP phases [e.g., Rost and Revenaugh, 2003], scattered PKP core phases [e.g., Vidale and Hedlin, 1998; Niu and Wen, 2001], or waveform analyses of SPdKS [e.g., Thorne and Garnero, 2004]. Information on the Vs structure in the ULVZ using the above probes is typically coupled (to some degree) to Vp structure. Avants et al., [2005] introduce stacks of ScS data to independently characterize ULVZ shear velocity structure. Partial melting is thought to be the main contributing factor to the low velocities observed in the ULVZ, if a 3:1 ratio in Vs to Vp decrement is constrained [Williams and Garnero, 1996]. There is broad interest in understanding how this enigmatic D" region relates to planetary evolution and differentiation, and how this lower mantle boundary layer modulates ongoing deep processes such as outer core convection, the geodynamo, heat flux into the mantle, and possibly even surface processes such as hotspot volcanism [e.g., Lay et al., 1998; 2004].

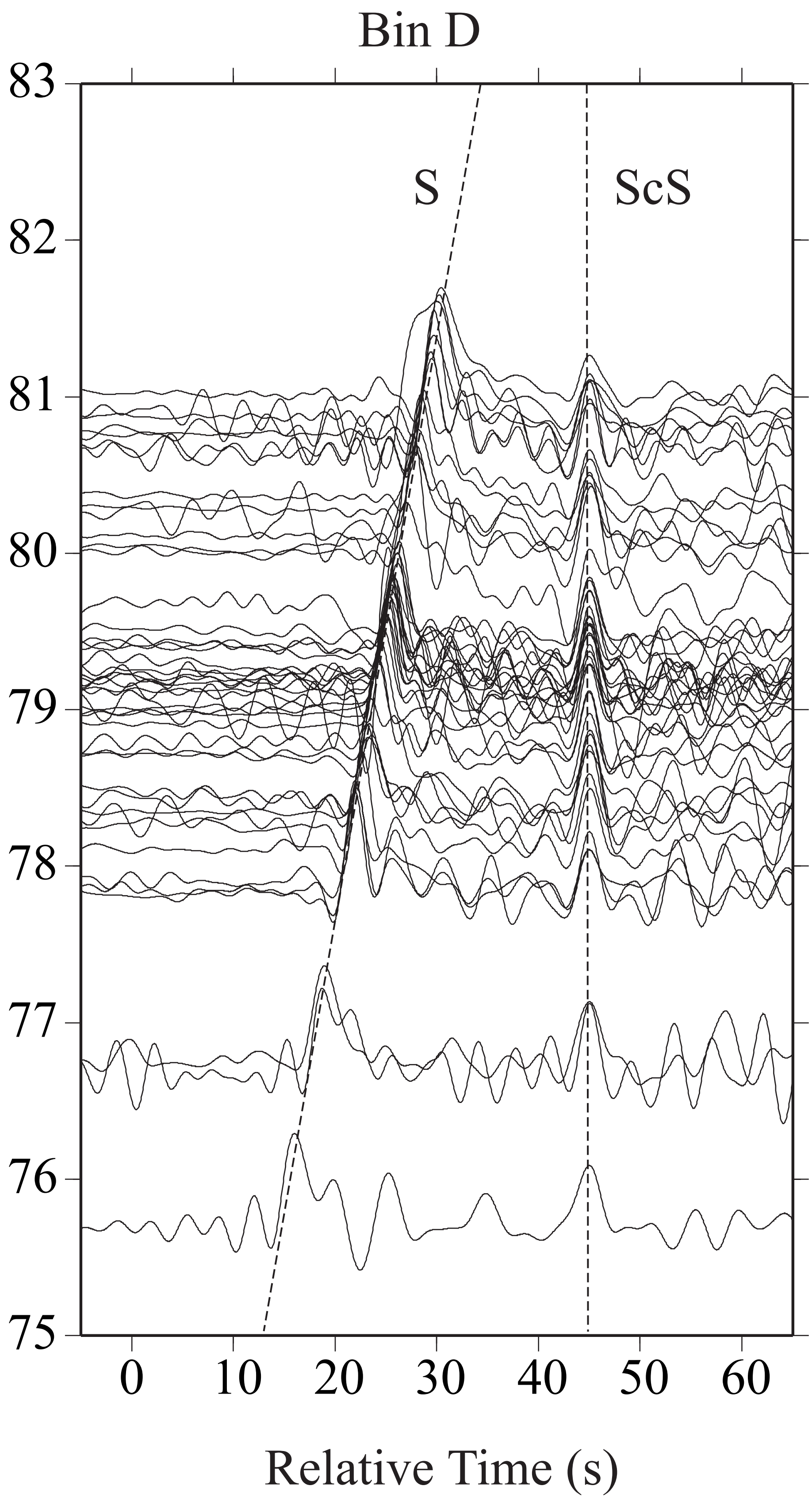

Event 03/31/1994
Event 10/06/1995
S
ScS
S
ScS
Distance (degrees)
Relative Time (s)
84
83
82
81
80
80
79
78
77
76
0
10
20
30
40
50
60
0
10
20
30
40
50
60



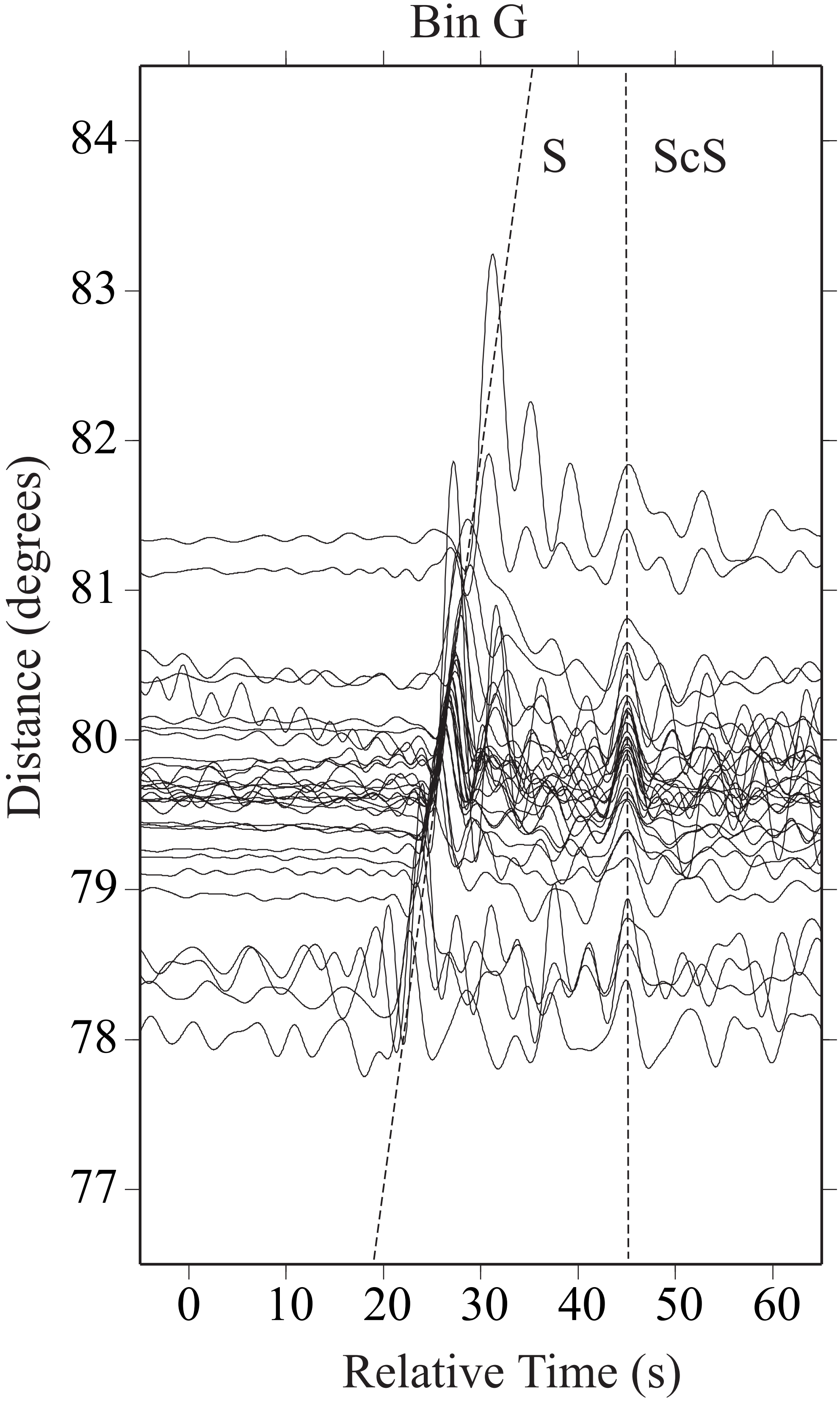
Event 12/18/2000
Event 11/05/2001
S
ScS
S
ScS
Distance (degrees)
83
82
81
80
79
80
79
78
77
76
0
10
20
30
40
50
60
0
10
20
30
40
50
60
Relative Time (s)



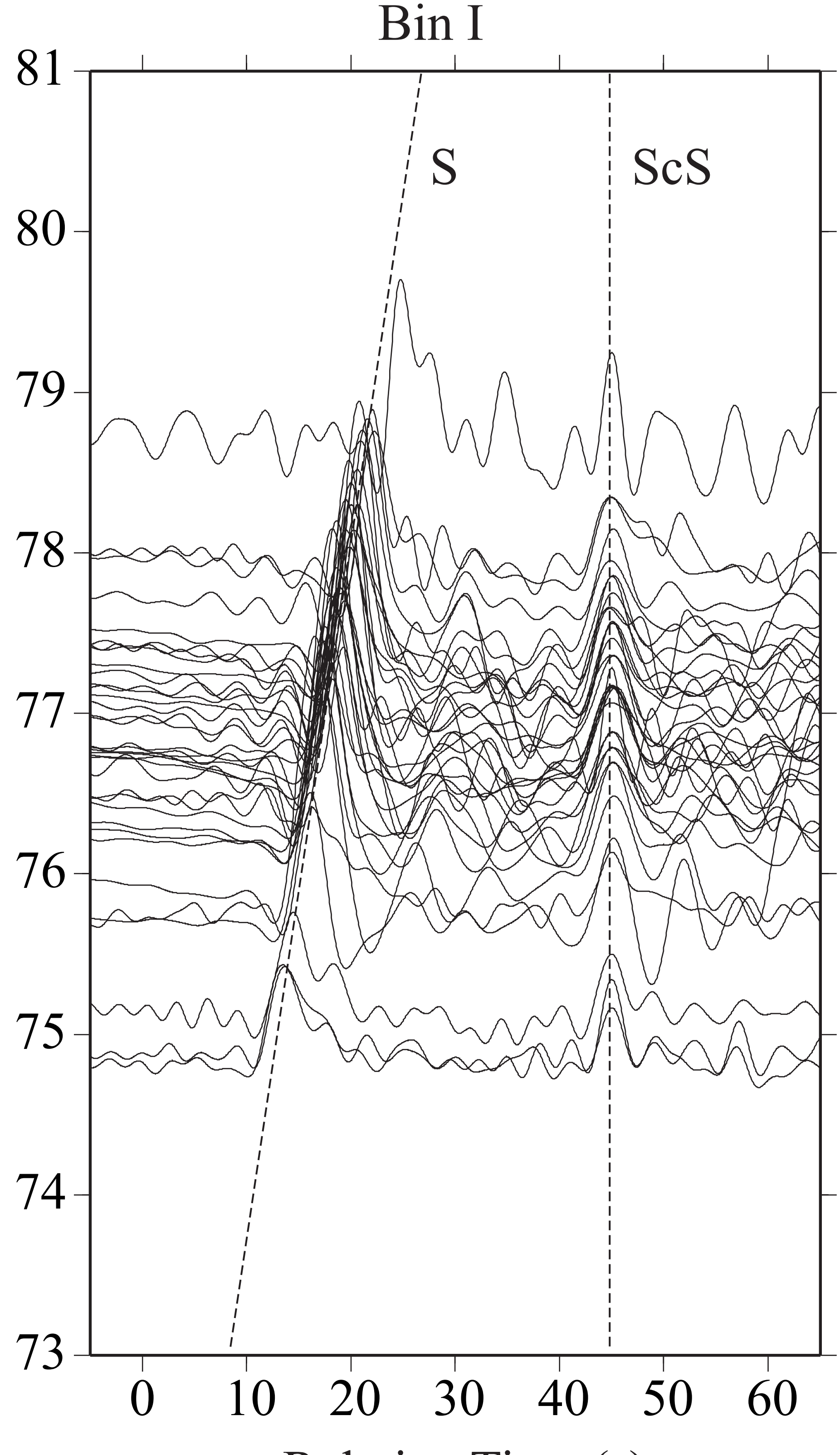
Bin C
S
ScS
Distance (degrees)
80
79
78
77
76
75
74
73
72
0
10
20
30
40
50
60



Bin D
S
ScS
83
82
81
80
79
78
77
76
75
0
10
20
30
40
50
60
Relative Time (s)



Bin G
S
ScS
84
83
82
81
80
79
78
77
Distance (degrees)
0
10
20
30
40
50
60
Relative Time (s)


Bin I
S
ScS
81
80
79
78
77
76
75
74
73
0
10
20
30
40
50
60
Relative Time (s)