Supplemental Material for: **22Jul13**

"Diverse rupture modes for surface-deforming upper-plate earthquakes in the southern Puget Lowland of Washington State" by Nelson et al.

Introduction

This data set contains tables and figures that describe basic data for sites described in the paper for which basic data are not summarized elsewhere. For many sites described in the paper, links are provided in the text of the paper and figure captions to reports that describe in detail field and laboratory data for those sites, including maps and figures made from LiDAR imagery. Below we list two tables, a large-format photomosaic of the Spotted Frog trench, and five other supplemental figures for sites mentioned but not described in detail in the text of the paper. Additional references cited in captions for the figures are listed below. All the files are pdf files readable with Adobe Reader 8 and higher.

Tables

Table S1. Data for radiocarbon ages that limit the times of surface deformation in the Seattle and Tacoma fault zones and Saddle Mountain deformation zone

Table S2. Code listing for OxCal models used to calculate probability distributions for the times of earthquakes

Figures

Figure S1. Annotated photomosaic showing the west wall of the Spotted Frog trench, IslandWood scarp, Bainbridge Island. Text on the mosaic explains how displacement across the scarp, scarp height, and slip during two earthquakes were measured or estimated. Best viewed in a format of at least 38x70 cm.

Figure S2. Parts (a) and (b) of figure showing maps and profile locations for our LiDAR analysis of shoreline angles at the back of the uplifted marine terrace on eastern Bainbridge Island.

Figure S3. Parts (a) and (b) of figure explaining the results of our LiDAR analysis of shoreline angles at the back of the uplifted marine terrace on eastern Bainbridge Island.

Figure S4. Descriptions of cores and a sketch map showing core locations at the Madrone East core site, Waterman Point fault scarp.

Figure S5. Descriptions of the composite core section and a sketch map showing locations of cores used at the Wataugua Beach core site, Waterman Point fault scarp.

Figure S6. Simplified trench log and sequence of events for the Cedars trench, Stansberry Lake scarps [see detailed trench log on sheet 3 of *Nelson et al.,* 2008a].

Additional References Cited in Figure Captions and Table S1 in the Supplemental Material

Nelson, A. R., S. F. Personius, J. Buck, L. Bradley, B. L. Sherrod, G. Henley II, L. M. Liberty, H. M. Kelsey, R. C. Witter, R. D. Koehler III, and E. R. Schermer, 2008a, Field and laboratory data from an earthquake history study of scarps in the hanging wall of the Tacoma Fault, Mason and Pierce Counties, Washington: U.S. Geological Survey Scientific Investigations Map 3060, 3 plates, includes interpretive text, http://pubs.er.usgs.gov/usgspubs/sim/sim3060.

Nelson, A. R., Y. Sawai, A. E. Jennings, L. Bradley, L. Gerson, B. L. Sherrod, J. Sabean, and B. P. Horton, 2008b, Great-earthquake paleogeodesy and tsunamis of the past 2000 years at Alsea Bay, central Oregon coast, USA: Quat. Sci. Rev., v. 27(7-8), p. 747-768.

Stuiver, M. and G. W. Pearson, 1986, High-precision calibration of the radiocarbon time scale, AD 1950-500 BC, in Proceeding of the 12th International ^{14}C Conference, edited by M. Stuiver and R. S. Kra: Radiocarbon, v. 28(2B), p. 805-838.

Tröels-Smith, J. (1955), Characterization of unconsolidated sediments: Geological Survey of Denmark, Series IV. V. 3, No. 10, 72 pp.

Table S1. Data for radiocarbon ages that limit the times of late Holocene surface deformation in the Seattle and Tacoma fault zones and Saddle Mountain deformation zone

Field sample no.	Site, unit or core no.	Station or depth (m)[1]	Radiocarbon lab no.[2]	Lab-reported age (^{14}C yr B.P. at 1σ)[3]	Calibrated age (cal yr B.P. at 2σ)[4]	Calibrated age (cal yr A.D. at 2σ)[4]	Inferred age context[5]	Sample wt.(mg)[6]	^{13}C (‰)[7]	Description of dated material[8]
Seattle fault zone										
Bainbridge Island										
Winslow marsh – Eagle Harbor (Bucknam et al., 1992)										
--	--	1.50	GX-16227	847±45	900-680	1040-1270	min D	--	--	leaf bases of *Triglochin maritima*
--	--	1.81	**GX-16226**	**1081±66**	**1170-800**	**780-1150**	**max D**	--	--	wood in peat
--	--	1.93	Beta-36044	1670±60	1800-1410	240-530		--	--	peat
--	--	2.20	GX-16225	1920±100	2120-1610	-170-330		--	--	leaf
Spotted Frog trench – IslandWood scarp (this paper)										
--	--	0.50	**Beta-183272**	**1290±40**	**1290-1160**	**660-790**	**max D**	--	--	charcoal fragments in fault overridden B horizon
--	--	0.98	Beta-183270	1710±40	1710-1530	240-420		--	--	charcoal fragments in faulted A horizon
--	--	0.58	Beta-183271	2460±40	2730-2360	-780 - -410		--	--	charcoal fragments in fault overridden B horizon
--	--	0.98	Beta-183269	2510±40	2740-2380	-790- -430		--	--	charcoal fragments in faulted A horizon
Bear's Lair trench – Toe Jam Hill scarp (Nelson et al., 2002; 2003a)										
ARN98-60B	9cA	9.79, 1.12	**Beta-125831**	**1160±50**	**1230-960**	**720-990**	**close max D**	12.9	-24.8	*Thuja plicata* leaf attached to block of mud
ARN98-60C	9cA	9.79, 1.12	GX-26075	1590±40	1560-1390	390-560		7.7	-23.8	decayed wood in 2-cm block of peaty mud
ARN98-58A	9cA	9.69, 2.06	GX-26076	2030±40	2110-1890	-160-60		35.4s	-26.4	charcoal in block of peaty mud
SP98-6	9bA	9.0, 3.1	Beta-123796	290±40*	470-150	1480-1790		4 g	-27.6	charcoal fragments
ARN98-61	6E	7.24, 2.90	OS-27229	4780±40	5590-5330	-3650 - -3380		22.1s	-26.3	10-12-mm charcoal fragments
BL-4	5d	1.4, 1.5	OS-28470	5730±35	6640-6440	-4680 - -4490		26.8	-25.9	3 5-10-mm-long charcoal fragments
BL-2	4	1.0, 1.2	CAMS-70167	3030±40	3360-3080	-1410 - -1130		10.8s	-26.2	22 <1-mm clean wood charcoal fragments
Saddle trench – Toe Jam Hill scarp (Nelson et al., 2002; 2003a)										
SP98-14	8aAB	10.0, 5.0	Beta-123797	400±40*	520-320	1430-1630		80 g	-25.1	charred wood and bark
ARN98-71A	7bA	9.5, 4.9	GX-26078	3600±40	4080-3730	-2130 - -1780		25.1	-26.1	charcoal fragments and seed case
ARN98-71C	7bA	9.5, 4.9	OS-25339	3710±45	4220-3910	-2270 - -1960		63.7	-26.7	unabraded charcoal twig
ARN98-44A	7aA	12.05, 3.70	Beta-125682	3930±70	4570-4150	-2620 - -2200		132.2	-23.4	charcoal fragment
ARN98-44B	7aA	12.05, 3.70	OS-25276	3745±28	4230-3990	-2280 - -2040		22.4	-23.0	charcoal fragment
ARN98-67B	7aA	11.95, 3.53	OS-25278	3220±45	3560-3360	-1610 - -1420		23.3	-24.6	dense charcoal fragments
ARN98-46	7aA	11.72, 3.52	**Beta-125683**	**3020±50**	**3360-3060**	**-1410 - -1130**	**max B**	53.2	-24.3	charcoal fragments
ARN98-47	7aA	11.9, 3.4	OS-24906	3320±65	3700-3390	-1750 - -1450		10.4s	-23.6	two charcoal fragments
ARN98-48	7aA	12.03, 3.43	OS-25277	3760±40	4250-3980	-2290 - -2040		18.2	-24.1	25 charcoal fragments
ARN98-65	7aA	12.5, 3.12	Beta-125685	1880±40	1920-1710	50-230		19.2	-25.1	fragments of charred wood
ARN98-64	6a	1.8, 6.23	OS- 24905	2230±50	2350-2120	-390 - -180		16.8s	-23.9	five charcoal fragments
Mossy Lane trench – Toe Jam Hill scarp (Nelson et al., 2002; 2003a)										
ML-5	4dA	15.98-2.51	**OS-27359**	**1230±30**	**1270-1060**	**690-880**	**close min C and max D**	46.7	-25.9	charred bark
ML-9	4dA	13.54-70, 2.80	GX-26085	1570±40	1540-1350	410-570		35.6	-22.9	two charcoal fragments
ML-54	4dA	13.1-5, 2.7-8	**OS-25852**	**1300±21**	**1290-1170**	**660-770**	**close min C and max D**	108	-22.1	outermost 7-10 rings of charcoal log
ML-2	4dB	15.42, 2.41	GX-26084	2950±40	3250-2960	-1300 - -1030		24.5	-24.5	two charcoal fragments
ML-14	4bAEB	11.87-97, 4.29	GX-26086	1370±50	1370-1170	580-770		8.2	-24.0	12-mm-long charcoal fragment
ML-16	4bAEB	11.48-61, 4.22-24	Beta-141780	1500±40	1520-1300	430-640		13.9	-23.7	thin charcoal fragments of charcoal
ML-49B	4aAB	11.2-6, 4.48-58	OS-28472	4050±50	4810-4410	-2860 - -2470		47.6	-24.5	hundreds of 0.2-mm charcoal flakes

ML-51A	2AEB	10.0-8, 4.2-5	OS-25852	1360±85	1420-1060	540-890		11.2	-29.4	charcoal twig
ML-51B	2AEB	10.0-8, 4.2-5	**Beta-141781**	**1360±40**	**1350-1170**	**600-770**	**close max C**	20.0	-24.6	three 3-mm-long charcoal fragments
ML-17	2AEB	10.30, 4.29	GX-26083	1760±50	1820-1550	130-390		32.8	-25.4	one quarter of 15-mm-long charcoal fragment
ML-7	2AEB	10.55-68, 4.38-40	OS-25648	1440±90	1530-1170	420-770		7.5s	-27.1	knobby charcoal twig
ML-46	2AEB	9.05-95, 4.8-5.0	OS-25649	1590±110	1730-1280	220-660		11.3	-25.9	clean fragments of charcoal
ML-48	2AEB	9.1-5, 4.6-9	OS-25812	1240±35	1270-1060	680-880		18.3	-26.6	43 seeds or fecal pellets
ML-19	2AEB	9.25, 4.76	**GX-26087**	**1410±40**	**1390-1260**	**570-670**	**close max C**	10.2	-26.9	5-mm-long charcoal fragment

Blacktail trench – Toe Jam Hill scarp (Nelson et al., 2002; 2003a)

BT-59	11aB/E	21.0, 5.2	OS-23301	1960±35	2000-1820	-40-120		9.3	-29.7	charcoal fragment
BT-53	10b	11.7, 2.85	Beta-141688	290±50*	480-150	1460-1950		18 g	--	large pieces of charcoal and charred wood
BT-54	10b	12.2, 2.95	**Beta-137175**	**980±80***	**1060-720**	**890-1220**	**min D?**	6.5 g	--	pieces of charcoal
BT-55	10b	12.95, 3.2	Beta-141689	230±50*	440-0	1510-1950		52 g	--	large pieces of charcoal and charred wood
BT-51	10a	11.6, 2.6	**OS-23308**	**1340±45**	**1330-1170**	**620-770**	**max D?**	34.7	-25.1	charcoal fragment
BT-50	9bB/E	10.1, 2.1	**GX-26089**	**1320±40**	**1300-1170**	**650-770**	**max C or D**	18.8	-21.3	two fragments of slightly abraded wood
BT-48	9bB/E	9.6, 2.0	OS-25442	315±40	470-290	1470-1650		32.4	-25.7	charcoal fragment
BT-64A	7dA	10.7, 1.8	OS-25439	55±40	270-0	1690-1930		21.7	-26.6	three fragments light-brown abraded wood
BT-6	5c	24.7, 2.9	GX-26088	160±40	290-0	1660-1950		26.4	-27.9	8-cm-long, black, *Equisetum*-type root sheath

Crane Lake trench – Toe Jam Hill scarp (Nelson et al., 2002; 2003a)

CL-66	14d	14.6, 6.3 se	OS-28476	1810±45	1870-1600	80-330		15.5	-26.9	six charcoal fragments
CL-48	14bAB	12.80, 4.95	OS-23307	1290±30	1290-1170	660-770		11.0	-23.0	two charcoal fragments
CL-45	14a	12.05, 4.17	**OS-23309**	**1060±30**	**1060-920**	**900-1020**	**close max D**	12.9	-24.4	clean charcoal sticks from forest-floor
CL-46	14a	12.22, 3.86	**GX-26082**	**1240±50**	**1290-1050**	**670-890**	**max D**	94.7	-23.3	charcoal fragment
CL-55	13eBw	13.88, 6.00	OS-23312	1390±35	1360-1240	590-680		21.9	-24.6	part of charred conifer seed?
CL-63	13bAB	13.3, 6.0	OS-28475	575±40	650-520	1300-1420		18.4	-29.4	five fragments charred wood and charcoal
CL-49	12	13.10, 5.61	**OS-23305**	**1290±30**	**1290-1170**	**660-770**	**max D**	12.2	-24.5	charcoal fragment
CL-14	12	13.40, 5.88	**GX-26081**	**1470±40**	**1490-1290**	**470-650**	**min C**	88.2	-25.3	three charcoal fragments
CL-56D	10	14.69-79, 5.55-60	**Beta- 141778**	**1520±40**	**1520-1310**	**430-620**	**max C**	33.4	-29.8	charcoal fragments, largest with twig morphology
CL-56C	10	14.69-79, 5.55-60	OS-23303	1680±30	1700-1520	260-420		5.6	-23.9	two charcoal fragments
CL-12	10	13.65, 5.22	OS-23306	1896±19	1900-1730	60-210		62.5	-24.9	resinous fragment of charcoal
CL-51	10	14.20, 5.48	GX-26073	2920±40	3210-2940	-1260 - -1010		16.7	-25.1	dense, resinous charcoal fragments
CL-57	9A	15.3, 5.5	GX-26074	1940±40	2000-1810	-40-140		193.3s	-22.1	decayed soft charcoal fragments
CL-58	9A	15.4, 5.85	**Beta-137174**	**1810±60***	**1880-1560**	**70-380**	**max C**	9.3 g	--	pieces of clean charcoal
CL-44B	9A	15.33, 5.51	Beta-141777	1990±40	2050-1820	-90-120		40.1	-26.0	decayed charcoal fragment
CL-44A	9A	15.33, 5.51	**OS-24762**	**2010±30**	**2050-1880**	**-90-70**	**min B**	44.9	-25.5	decayed charcoal fragment
CL-59	8c	13.15, 4.7	OS-23310	4020±35	4580-4410	-2620 - -2470		10.1	-23.6	charcoal fragment within soil ped
CL-59B	8c	13.15, 4.7	OS-27228	5050±85	5930-5600	-4030 - -3660		40.5	-24.2	charcoal fragments
CL-47	8b	12.58, 4.40	**GX-26072**	**2440±30**	**2720-2350**	**-750 - -410**	**max B**	9.9	-26.7	charcoal fragment
CL-50	7A	13.45, 4.65	**OS-23302**	**2550±30**	**2750-2500**	**-800 - -550**	**max B**	16.1	-25.2	clean charcoal fragment
CL-52A	7A	13.25-37, 4.42-49	OS-23290	3090±35	3390-3210	-1430 - -1270		10s	-25.1	wood and herb charcoal fragments
CL-52B	7A	13.25-37, 4.42-49	OS-28474	5010±50	5900-5610	-3950 - -3700		24.4	-26.0	ten fragments charcoal
CL-53	7A	14.02-24, 4.68-73	OS-26217	5240±320	6750-5250	-4830 - -3360		10s	-24.3	charcoal-rich, 2-mm-thick laminae
CL-35	6c	10.10, 3.18	OS-28473	2390±50	2720-2330	-750 - -390		32.0	-26.4	seven charcoal fragments
CL-40	6bA	12.06, 3.37	GX-26071	2850±40	3140-2850	-1190 - -910		42.9	-23.9	charcoal fragment
CL-36	6a	11.97, 3.82	OS-25344	1700±50	1740-1510	220-530		74.0	-24.3	dense subangular charcoal fragments

Restoration Point – uplifted marine terrace (Bucknam et al., 1992; Sherrod et al., 2000)

880830.02A	--	0.32	Beta-28884	620±90	720-510	1230-1440	min D	--	-26.9	humus concentrate from basal 4 cm of organic-rich sand
--	--	0.28	Beta-36045	1560±90	1690-1300	260-650	max D	--	--	rounded fragments of detrital charcoal
--	--	0.85	Beta-29143	1770±70	1860-1540	80-410		--	-27.4	peat

Point Glover area

Snowberry trench – Waterman Point scarp (Nelson et al., 2003b)

SB-69	8b	16.21, 4.5	OS-33844	410±40	530-310	1430-1630		45.9	-26.4	flakes of carbonized bark or root sheath
SB-12	6bAB	16.25, 2.95	**OS-33840**	**1117±26**	**1070-960**	**880-990**	**close max D**	79.1	-25.1	split 15x15x10-mm fragment from bed of charcoal
SB-13 check	6bAB	16.20, 3.16	**OS-33841**	**1000±40**	**980-790**	**970-1150**	**max E**	47.0	-25.1	10x5x4-mm fragment from bed of charcoal
SB-22	6bAB	15.53, 3.91	OS-33846	1262±30	1280-1080	670-860		115.3	-25.1	split 15x10x3-mm-charcoal fragment into halves
SB-15	6aAB	14.88, 2.85	OS-33842	1660±40	1700-1410	260-530		93.5	-25.1	10x10x10-mm charcoal fragment
SB-62	4d	3.65, 1.81	OS-33843	2830±45	3080-2790	-1130 - -850		87.9	-26.9	two 12x5x4-mm charcoal fragment from bed of charcoal

Madrone Ridge trench – Waterman Point scarp (Nelson et al., 2003b)

MR-49	8b	13.90, 4.72	OS-34041	1760±35	1820-1560	140-380		74.6	-24.2	15x6x4-mm charcoal fragment
MR-47	8b	13.45, 4.81	OS-34424	1940±30	1950-1820	-20-130		31.0	-24.9	6x5x4-mm charcoal fragment
MR-52	8a	11.54, 3.63	OS-34425	1820±30	1830-1630	90-320		52.2	-25.3	8x4x4-mm charcoal fragment
MR-51	8a	11.16, 3.45	**OS-34042**	**1540±35**	**1520-1360**	**430-590**	**max E**	44.3	-25.5	15x4x4-mm charcoal fragment
MR-58	7b	9.98, 3.57	OS-33859	165±35	300-0	1660-1950		51.0	-24.9	two charcoal fragments: 15x4x3 and 8x5x1 mm
MR-46	6b	9.91, 3.36	OS-35166	2270±40	2350-2150	-400 - -200		81.7	-22.8	two charcoal fragments: 15x4x4 and 8x4x3 mm
MR-45	6b	9.62, 3.38	OS-34040	1850±35	1880-1700	80-240		52.8	-24.5	13x4x4-mm charcoal fragment
MR-55A	6aAB	10.60, 3.14	OS-34043	1680±45	1710-1420	240-530		90.6	-24.4	10x10x5-mm charcoal fragment
MR-55B	6aAB	10.60, 3.14	OS-35170	2481±30	2720-2360	-770 - -420		35.0	-24.1	split 18x15x3-mm charcoal fragment into halves
MR-41	6aAB	10.58, 3.16	**OS-35169**	**1601±25**	**1540-1410**	**410-540**	**max E**	47.0	-22.7	split 13x6x4-mm charcoal fragment into halves
MR-56	6aAB	10.07, 3.31	CAMS-84714	2170±70	2340-1990	-390 - -50		7.7s	-25a	small charcoal fragments from 4x3x1-mm fragment
MR-44	6aAB	10.04, 3.28	OS-35217	1660±40	1700-1410	260-530		165s	-24.6	small charcoal fragments from 4x3x2-mm fragment
MR-54	5	10.94, 3.10	OS-33858	1756±28	1740-1560	180-380		163.1	-25.1	10x10x1-mm charcoal fragment
MR-42	5	9.98, 3.16	OS-35216	3070±30	3360-3170	-1410 - -1270		59.6	-24.1	14x6x4-mm charcoal fragment
MR-39	4c	8.68, 2.40	OS-34204	1950±40	2000-1810	-40-130		79.8	-24.9	two charcoal fragments: 12x8x2 and 16x3x2 mm
MR-37	4c	9.04, 2.33	OS-35168	2040±35	2120-1890	-170-50		66.1	-26.0	two charcoal fragments: 7x6x3 and 10x7x4 mm
MR-36	4bAB	9.25, 2.27	OS-33856	1440±95	1540-1170	410-770		64.8	-26.5	12x5x4-mm charcoal fragment
MR-33	4bAB	10.73, 2.12	OS-35167	1700±50	1740-1510	220-530		127s	-24.2	many 4x1x1-mm soft charcoal fragments
MR-34	4bAB	10.15, 2.18	**OS-35215**	**1300±30**	**1290-1180**	**660-770**	**max D**	72.9	-25.8	five 5x3x2-mm dense charcoal fragment
MR-35	4bAB	9.75, 2.25	OS-33855	**1290±35**	**1290-1140**	**650-800**	**max D**	25.9	-25.1	one 5x2x1 and two 8x4x2-mm charcoal fragments

Nettle Grove trench – Waterman Point scarp (Nelson et al., 2003b)

NG-25	7b	11.17, 3.38	OS-33853	1690±40	1710-1520	250-430		26.9	-26.1	9x4x2-mm charcoal fragment
NG-23	7a	10.85, 3.20	OS-35214	1520±30	1520-1330	430-610		32.3	-25.1	two 8x6x1-mm platy bark-like charcoal fragments
NG-24	7a	10.80, 3.28	OS-34039	1670±30	1690-1510	260-430		21.9	-25.9	one 5x4x2 and two 3x2x1-mm charcoal fragments
NG-26	7a	9.02, 2.31	OS-33854	2240±30	2350-2150	-390 - -210		67.4	-24.7	two 5x4x2-mm charcoal fragments
NG-16	6	11.55, 2.25	OS-35164	1530±45	1530-1320	420-620		64.3	-23.5	about 20 3x4-mm flakes
NG-22	5bAB	10.34, 2.78	OS-33850	1640±45	1690-1410	260-540		43.2	-25.9	two charcoal fragments: 5x3x2 and 4x2x2 mm
NG-19	5bAB	11.44, 2.21	**OS-33852**	**1181±26**	**1180-1010**	**770-940**	**close max D**	63.1	-26.2	split 20x10x5-mm charcoal fragment into halves
NG-18	5bAB	10.32, 2.13	OS-33848	1400±35	1390-1260	580-670		25.6	-26.2	two 10x4x1-mm charcoal fragments
NG-21	5aBC	10.75, 2.16	OS-33849	1550±55	1540-1310	400-620		41.1	-29.4	one 2x3x4-mm and many smaller charcoal fragments
NG-20	5aBC	10.66, 2.23	OS-35165	3820±40	4410-4080	-2460 - -2140		24.7	-25.4	four 4x4x2-mm charcoal fragments

Madrone East core transect – Waterman Point scarp (this paper)

ARN03-08	4	0.24	**CAMS-101659**	**735±35**	**730-570**	**1220-1380**	**min D**	28.9	--	5x8mm hard woody seed, *Prunus*-type
ARN03-06	1	0.32	**CAMS-101658**	**1220±40**	**1270-1060**	**680-890**	**close max D**	13.1	--	7x4mm hard woody seed, *Prunus*-type
ARN03-11C	4	0.72	CAMS-101661	7960±40	8990-8650	-7040 - -6700		12.4	--	2 wood charcoal fragments, 4x3,3x2mm
ARN03-11B	4	0.74	CAMS-101660	8335±45	9470-9150	-7520 - -7200		20.3	--	3 wood charcoal fragments, 5x3,4x2,2x2mm

Wataugua Beach West core site – Waterman Point scarp (this paper)

ARN03-04A	5	0.92	**CAMS-101656**	**925±40**	**930-740**	**1020-1210**	**close max E close min D**	2.6	--	14-mm-long *Pseudotsuga menziesii* petiole
ARN03-04B	5	0.92	**CAMS-101657**	**1025±40**	**1050-800**	**900-1150**	**max E**	26.5	--	21 *Pseudotsuga menziesii* leaves + *Tsuga heterophylla* bract
ARN03-02	3	1.16	**CAMS-101655**	**1005±40**	**1050-790**	**900-1150**	**close min D and max E**	34.2	--	6x12mm fresh herb bract or bud

ARN03-01	3	1.17	CAMS-101654	1915±40	1950-1730	2-210	max D	14.5	--	6 wood charcoal fragments, 2 *Pseudotsuga menziesii* leaves
ARN03-03	3	1.32	**OS-80891**	**1150±30**	**1170-980**	**780-970**	**close max D**	4.9	-24.74	12-mm-long twig with bark and petioles

Gorst wetland – Sinclair Inlet (Arcos, 2012)

Wetland	--	0.4	**Beta-263042**	**700±40**	**710-560**	**1240-1390**	**min D**	--	--	*Tsuga heterophylla* cone 2 cm above sand
Gorst Creek	--	1.2	**OS-78396**	**1100±25**	**1060-960**	**890-990**	**close max D**	--	--	deciduous leaf in lower 5 cm of debris flow deposit
Gorst Creek	--	1.2	**OS-78394**	**1190±30**	**1230-1010**	**720-940**	**max D**	--	--	deciduous leaf in lower 5 cm of debris flow deposit
Gorst Creek	--	1.2	**OS-78395**	**1240±30**	**1260-1070**	**680-870**	**max D**	--	--	deciduous leaf in lower 5 cm of debris flow deposit
Jarstad Park	--	--	Beta-263043	1390±40	1380-1260	570-690	max D	--	--	charcoal 5 cm below debris flow deposit
Wetland	--	1.0	Beta-263044	1540±70	1160-900	790-1050	max D	--	--	shell in mud 5 cm below sand

East of Puget Sound

West Point – excavation of log in tsunami-deposited sand (Atwater, 1999; Sherrod, 2001)

	C	3.1	**QL-4644**	**1100±15**	**1060-960**	**890-990**	**close max D**	**--**	**--**	outer 15 rings of tsunami-deposited log
	C	3.3	**QL-4623**	**1108±16**	**1060-960**	**890-990**	**close min D**	**--**	**--**	*Scirpus*-type stems in tsunami-deposited sand
			wiggle match of 5 ages		**1050-1020**	**900-930**	**round-number age interval for D**			log with almost complete bark in tsunami-deposited sand

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Tacoma fault zone

North of Tacoma fault

Lynch Cove marsh – Hood Canal (Bucknam et al., 1992; Sherrod et al., 2001)

1	--	0.43	GX-17121	403±62	530-310	1420-1640		--		leaf bases of *Triglochin maritima*
2	--	0.52	GX-17120	356±51	510-300	1450-1640		--		*Scirpus*-type
3	**--**	0.92	**Beta-29145**	**1170±90**	**1270-930**	**680-1020**	**close min D**	**--**		basal peat
4	**--**	1.00	**QL-4658**	**1132±17**	**1170-960**	**780-990**	**close min D**	**--**		leaf bases of *Triglochin maritima*
5	**--**	1.05	**QL-4881**	**1159±14**	**1170-980**	**780-960**	**close max D**	**--**		trunk of small tree embedded in sand
	--	1.6	**Beta-36046**	**1050±70**	**1170-790**	**780-1160**	**close max D**	**--**		woody root in growth position
	--	1.1	Beta_45382	1420±70	1510-1180	430-770	max D	**--**		well rounded detrital wood fragment
	--	1.4	GX-16267	2700±85	3070-2550	-1120 - -590				shells of *Ostrea lurida*

Snake trench – Sunset Beach scarps (Nelson et al., 2008)

SK-25	5bBw	5.35, 2.50	OS-43390	1600±65	1690-1340	260-600		11.4	-25.5	10x3x5-mm fragment of burned wood
SK-28	5bBw	6.21, 1.60	CAMS-101667	1455±35	1410-1290	550-650		10.6s	-24.2	4 delicate 2x1x1-mm charcoal fragments
SK-29	5bBw	6.55, 2.42	**OS-43060**	**1280±45**	**1290-1080**	**660-870**	**max D**	11.7	-26.7	5x5x4-mm fragile charcoal fragment
SK-31	5bBw	6.36, 1.50	CAMS-101668	2120±40	2310-1990	-350 - -40		18.7s	-24.9	8x4x4-mm dense charcoal fragment
SK-6	5bBw	5.64, 2.19	OS-43059	5750±40	6660-6440	-4700 - -4500		23.7	-26.0	10x6x2 bark-like charcoal fragment

Bee's Nest trench – Sunset Beach scarps (Nelson et al., 2008)

BN-2	3bBw	5.85, 3.04	CAMS-101664	3980±40	4570-4330	-2620 - -2350		10.5	-26.4	9x5x4-mm charcoal fragment
BN-4	3bBw	6.10, 3.11	CAMS-101665	6175±40	7230-6940	-5220 - -5000		51.6	-25.1	9x8x7-mm dense charcoal fragment
BN-6	5C	6.06, 3.21	**CAMS-101666**	**1280±40**	**1290-1080**	**660-860**	**max D**	8.1	-25.1	6x2x1-mm charcoal fragment
BN-7	5C	6.10, 3.30	OS-43058	3680±40	4150-3890	-2200 - -1950		17.9	-24.0	6x14x4-mm charcoal fragment

Burley marsh – (Bucknam et al., 1992; Sherrod et al., 2004a; 2004b)

96RB111	10	0.36 m	Beta-93549	700±60	740-550	1220-1400		--	-26.9	woody freshwater peat
95RB124	11	0.83 m	**Beta-86419**	**1130±40**	**1180-950**	**780-1010**	**close min D**	70.0	-26.6	leaf bases of *Triglochin maritime* from basal peat

Cedars trench – Catfish Lake scarps (Nelson et al., 2008)

CD-7	3b	1.78,5.47	CAMS-101662	5445±50	4450-4050	-4440 - -4080	max D	15.2s	-25.0	6x4x2-mm charcoal fragment
CD-8	3b	1.95,5.47	CAMS-101663	6240±40	5310-5060	-5310 - -5060		21.2	-25.0	15x2x2-mm charcoal fragment

Micah trench – Stansberry Lake scarp (Nelson et al., 2008)

MC-41	6a	10.55, 2.91	OS-57460	1240±85	1300-980	650-970		12.0	-27.2	8x3x2-mm partially burned fragment, outer 10mm root
MC-42	6a	10.68, 2.83	OS-58492	1080±25	1050-930	890-1020		40.2	-26.5	15x15x2-mm fragment from outer 10 mm of root
MC-43	6a	10.77, 2.92	OS-58714	1110±30	1070-940	880-1010		20.7	-26.0	8x6x2-mm platy charcoal fragment
		mean of ages from root 6a above		**1100±19**	**1060-960**	**890-990**	**close min D**			
MC-34	6d	9.93, 2.69	**OS-57079**	**1580±30**	**1530-1400**	**410-550**	**max D**	9.4	-25.0	5x4x1-mm platy charcoal fragment
MC-36	6d	9.84, 2.74	OS-57081	1680±30	1700-1520	260-420		17.9	-25.1	10x7x2-mm platy detrital charcoal fragment
MC-39	6d	9.07, 2.60	OS-57082	1740±30	1720-1560	230-390		11.3	-22.3	16x2x1-mm platy detrital charcoal fragment
MC-35	5f	9.10, 2.60	OS-57080	1640±30	1620-1410	340-530		25.7	-26.7	7x4x3-mm detrital charcoal fragment
MC-46	5f	8.76, 2.55	OS-57077	1630±25	1610-1410	350-530		8.7	-25.3	6x3x2-mm detrital charcoal fragment
MC-47	5f	9.01, 2.61	OS-57083	1670±30	1700-1520	260-430		17.6	-23.6	8x5x2-mm soft detrital charcoal fragment

Catfish Lake and Mill Pond – Catfish Lake scarps (Logan and Walsh, 2007)

1	21/1W29.14-3		**Beta-221634**	**1140±50**	**1180-940**	**770-1010**	**close max D**	--	-26.6	wood from stump in Catfish Lake
2	21/1W29.14-7		**Beta-221635**	**1290±60**	**1300-1070**	**650-880**	**max D**	--	-26.8	wood from stump in Catfish Lake
3	21/1W30.84-1		**Beta-221636**	**1240±60**	**1290-1010**	**660-940**	**max D**	--	-26.2	wood from stump in Mill Pond
4	21/1W30.84-2		**Beta-221637**	**1260±60**	**1290-1060**	**660-890**	**max D**	--	-27.2	wood from stump in Mill Pond

North Bay marsh – Case Inlet (Sherrod et al., 2004a; 2004b)

98RB010A	--	0.82	Beta-120149	660±50	680-540	1270-1400	min D	--	--	peat
98RCB009	--	1.05	Beta-119093	3150±70	3560-3160	-1610 - -1260	max D	--	--	marine mollusk shells

Allyn marsh – Catfish Lake scarps (Sherrod et al., 2004a; 2004b)

CATFISH 60-61	**--**	0.58	**Beta - 175551**	**1040±40**	**1060-830**	**890-1120**	**close min D**	**--**	**--**	seeds

South of Tacoma fault

Wollochet Bay marsh – (Sherrod et al., 2004a; 2004b)

12	**--**	0.87	**Beta-153520**	**970±50**	**970-760**	**980-1180**	**close max D?**	**--**	**--**	outermost rings of *Pseudotsuga menziesii* stump

Dumas Bay marsh – (Sherrod et al., 2004a; 2004b)

95RB103	--	4.18 m	Beta-84561	1930±60	2000-1720	-50-230	max D	--	-25.5	fibrous sandy peat

Nisqually marsh – (Sherrod et al., 2001)

		~3.0	**Beta-110150**	**1030±70**	**1170-780**	**780-1170**	**close min D**	--	--	leaf bases of *Triglochin maritima*

Nisqually - McAllister Creek marsh – (Sherrod et al., 2001)

		~2.3	**Beta-102336**	**1140±80**	**1260-930**	**690-1020**	**min D**	--	--	leaf bases of *Triglochin maritima* above buried soil

Nisqually - Red Salmon Creek marsh – (Sherrod et al., 2001)

		1.57	**Beta-110746**	**1010±50**	**1050-790**	**900-1160**	**close max D**	--	--	outer rings of *Pseudotsuga menziesii* stump
		1.57	**QL-4634**	**1200±14**	**1180-1060**	770-890	**max D**	--	--	*Pseudotsuga menziesii* stump
		1.57	**QL-4935**	**1184±11**	1170-1060	780-890		--	--	

		1.57	**QL-4937**	**1143±15** wiggle match 2 ages	1170-970 **1090-1010**	780-980 **860-940**	**close max D**	--	--	*Pseudotsuga menziesii* stump

Oakland Bay marsh – (Bucknam et al., 1992)

910522.01C	--	1.04	Beta-46730	1190±60	1260-980	690-970	max D	410 g	-28.3	basal peat above muddy sand

Little Skookum Inlet marsh – (Sherrod et al., 2001)

--	--	0.60	Beta-117091	140±60	280-0	1660-1950		--	--	
96BS205	--	0.75	**Beta-95912**	**1090±60**	**1170-920**	**780-1030**	**close max D**	--	-26.1	outer 15-25 rings of *Pseudotsuga menziesii* stump
KW8-5	--	on tide flat	Beta-102335	1220±50	1280-1010	670-940	max D	--	--	innermost 16 rings (offset 184 yr) of *Pseudotsuga menziesii* root
--	--	on tide flat	**QL-4633**	**1222±15**	**1260-1070**	**690-880**	**max D**	--	--	rings (offset 83 yr) in *Pseudotsuga menziesii* stump

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Saddle Mountain deformation zone

Saddle Mountain East faults (Wilson et al., 1979; Barnett et al., 2009; Polenz et al., 2011)

--	Saddle Mt. East, trench 1		W-3031	1600±200	1990-1090	-40-860	max Dsm	--	--	charcoal in scarp colluvium on downthrown side of fault
AT-02	Alligator trench, Dow Mt.		Beta-264361	1360±40	1350-1180	600-770	max Dsm?	--	-25.9	charcoal fragments in buried soil within colluvium
LS-04	Saddle Mt. East, trench 1		Beta-264364	1750±40	1810-1550	140-400	max Dsm	--	-24.5	charcoal fragments in soil on glacial deposits
AT-13	Alligator trench, Dow Mt.		Beta-264362	3370±40	3700-3480	-1750 - -1530	max Dsm	--	-24.4	charcoal fragments in soil on glacial deposits

Price Lake – Saddle Mountain East faults (Wilson et al., 1979; Jacoby et al., 1992; Hughes, 2005; Polenz et al., 2011)[5]

--	**I-7557**	**--**	**I-7557**	**1155±85**	**1270-930**	**680-1020**	**close max Dsme**	--	--	submerged stump in pond northeast of Saddle Mt. fault
--	--	--	I-7757	1315±80	1370-1060	580-890	max Dsme	--	--	stump submerged 3.4 m in Price Lake
--		--	WW-60	5100±500	7160-4650	-5210 - -2700	max Dsme --	--	--	stump submerged 3 m in Price Lake
--	**--**	**--**	**--**	**--**	**1290-1080**	**660-870**	**max Dsme**	--	--	conifer cones and needles; range of 2 concordant ages
--	**--**	**--**	**--**	**--**	**1270-1050**	**680-900**	**max Dsme**	--	--	*Tsuga heterophylla* cone
PLDRU M8	Hughes 2	--	**Beta-204316**	**1150±40**	**1170-970**	**660-870**	**close max Dsme**	--	-29.9	*Tsuga heterophylla* needles
PLTA 20-63	Hughes 3	0.64	**OS-46846**	**1210±35**	**1260-1060**	**690-890**	**max Dsme**	--	-26.0	*Thuja plicata* cone
PLTC 50-85-87	Hughes 6	0.88	**OS-47168**	**1230±40**	**1270-1060**	**680-890**	**max Dsme**	--	-21.6	leaves of wetland plants in top of submerged soil
PLTA 275-63	Hughes 7	0.63	**OS-46847**	**1240±30**	**1260-1070**	**680-870**	**max Dsme**	--	-26.8	wetland seed mixture in wetland deposit on top of submerged soil
PLTA 275-65	Hughes 7	0.66	**OS-47272**	**1250±30**	**1270-1080**	**680-870**	**max Dsme**	--	-25.7	*Thuja plicata* cone at top of submerged soil
PLC3 DI-88-89	Hughes 9	0.89	**Beta-193649**	**1270±40**	**1290-1080**	**660-870**	**max Dsme**	--	-27.8	*Tsuga heterophylla* needles in submerged soil

Price Lake – Saddle Mountain West faults (Hughes, 2005; Polenz et al., 2011)

PLC1 D3-2	Hughes 4	2.02	**Beta-193648**	**1210±40**	**1260-980**	**690-940**	**close max Dsmw**	--	-30.0	*Tsuga heterophylla* needles in submerged soil
PL 357IN	Hughes 5	--	**Beta-212219**	**1220±40**	**1270-1060**	**680-890**	**max Dsmw**	--	-22.5	top of submerged *Pseudotsuga menziesii* stump
PL 357EX	Hughes 5	--	**Beta-212218**	**1250±40**	**1280-1080**	**670-870**	**max Dsmw**	--	-21.1	top of submerged *Pseudotsuga menziesii* stump

Cargill Creek trench – Saddle Mountain West fault (Witter et al., 2008)

PL05RC-10	4bBw	6.53, 2.67	GX-32081	**1120±35**	**1170-940**	**780-1010**	**min Dsmw or max Dsmw?**	-- --	-25.1	charcoal in colluvium; may be minimum or maximum age
PL05RC-4	4bBw	6.22, 2.46	GX-32079	1390±50	1390-1180	560-770	max? Dsmw	--	-22.7	charcoal in colluvium; may be minimum or maximum age
PL05RC-15	5b	10.42, 4.25	GX-32082	1550±40	1530-1350	420-600	max Dsmw	--	-26.1	charcoal fragments
PL05RC-6	4a	6.17, 2.27	GX-32080	1760±40	1810-1560	140-380	max Dsmw	--	-26.7	charcoal fragments
PL05RC-18	3cBw	14.9, 6.82	GX-32084	1820±35	1860-1630	80-320	max Dsmw	--	-23.1	charcoal fragments

Dead Mole trench – Frigid Creek scarp – (Blakely et al., 2009; Polenz et al., 2011)

HB-018	6	--	CAMS-101673	415±40	530-320	1420-1630	min Dsm	--	-25a	charcoal fragments in soil overlying fault-related colluvium

HB-013	3b	--	CAMS-101671	3925±40	4510-4240	-2560 - 2290	max Dsm	--	-25a	charcoal fragments in buried soil
HB-015	3b	--	CAMS-101672	3990±40	4570-4300	-2620 - -2350	max Dsm	--	-25a	charcoal fragments in buried soil
HB-012	2	--	CAMS-101670	3990±40	4570-4300	-2620 - -2350	max Dsm	--	-25a	charcoal fragments in buried soil
HB-002	3b	--	CAMS-101669	4850±40	5660-5480	-3710 - -3530	max Dsm	--	-25a	charcoal fragments in buried soil

[1]Depth in core or location (horizontal, vertical) on reference grid used to map trench wall or exposure. Dashes indicate horizontal and vertical range over which sediment sample (from which dated sample was extracted) was collected. More complete location data for some ages in referenced publications. Two dashes indicate data not available; records for a few ages by Beta Analytic were lost in a hurricane in 1992. A small number of ages from referenced studies that provide no useful age constraints are not listed.

[2]Laboratories are: QL, Quaternary Isotope Laboratory, University of Washington, Seattle; OS, National Ocean Sciences AMS Facility, Woods Hole Oceanographic Institution; CAMS, Lawrence Livermore National Laboratories, California, GX, Geochron Laboratories, Cambridge, Massachusetts; Beta, Beta Analytic, Inc., Miami, Florida; I, Teledyne Isotopes, USA; W, National Center, U.S. Geological Survey, Reston, Virginia .

[3]Radiocarbon age reported by laboratory. Asterisk indicates gas-proportional or liquid-scintillation (Beta) radiometric age on samples weighing grams. QL ages are high-precision ages on cellulose extracted from wood (Stuiver et al., 1986). Other ages are AMS (accelerator mass spectrometer) ages. Quoted error for each AMS analysis is the larger of counting error or target reproducibility error. Reported ages for samples CL-12 and MC-43 are averages of three ages on the same charcoal fragment. Ages in bold constrain the times of earthquakes more closely than other ages and so are listed in Table 1 (see text).

[4]Ages in solar years calculated using OxCal (version 4.1; Bronk Ramsey, 1995; 2009; probability method) with the INTCAL09 dataset of Reimer et al. (2009) and rounded to nearest decade. QL ages are calibrated with an "error multiplier " of 1.6 (Stuiver et al., 1986). Other laboratories include total errors in their laboratory reported ages. Calibrated ages show time intervals of >95% probability distribution at 2σ. Ages shown on figures are weighted averages of probability distribution functions (Telford et al., 2004) rounded to the nearest 100 years.

[5]Interpretation of the stratigraphic context of dated samples that limit the times of earthquakes more closely than other samples**.** Maximum limiting ages are on samples containing carbon judged to be older than the earthquake, minimum limiting ages are on samples judged younger than the earthquake, and "close" ages are those on samples judged to contain carbon produced within a few decades of the earthquake. Context, sample type, and sample quality were used to infer whether age is a maximum age, minimum age, or close maximum age.

[6]Dashes indicate sample not weighed before submittal to laboratory or weight unavailable. Weights for radiometric samples in grams. "s" indicates samples with adhering sediment when submitted to dating laboratory; weight is a maximum for organic material in the sample.

[7]If no value is listed, ^{13}C was not not listed in publications or was not measured and assumed to be –25.0%o.

[8]Unless indicated otherwise, ages are on unabraded fragments of wood charcoal. In each sample, the largest, most angular, least decayed fragments of charcoal, wood, and/or herb parts were selected to minimize the chance of analyzing carbon much older than the host sediment. In most samples, fragments with root-like morphology were avoided to minimize the chance of analyzing roots much younger than the host sediment. Except for a few of the most delicate fragments, rootlets and sediment adhering to fragments were removed with brushes or dental tools in distilled water at 12-50x magnification.

[5]We list only the six ages that Polenz et al. (2011) describe as the closest maximum limiting ages on the time of forest and soil submergence in Price Lake due to faulting. Polenz et al. (2011, Appendix A) compile a total of 42 ages limiting the times of surface deformation in the Saddle Mountain deformation zone, including those listed here.

Table S2. Code listing for OxCal models used to calculate probability distributions for the times of earthquakes

Seattle fault zone	Tacoma fault zone	Saddle Mountain deformation zone

Earthquake B
Plot()
{
Sequence(earthquake B interval Sfz)
{
Boundary("maximum B");
Phase("maximum B")
{
R_Date("OS-23302", 2550, 30);
R_Date("GX-26072", 2440, 30);
};
Boundary("earthquake B interval");
R_Date("OS-24762", 2010, 30);
Boundary("minimum B");
};
};
 	
Earthquake C
Plot()
{
Sequence(earthquake C interval Sfz)
{
Boundary("maximum C");
Phase("maximum C")
{
R_Date("GX-26087", 1410, 40);
R_Date("Beta-141781", 1360, 40);
};
Boundary("earthquake C interval");
Phase("minimum C")
{
	Earthquake D
	Plot()
	{
	Sequence(earthquake D interval Tfz)
	{
	Boundary("maximum D");
	Phase("maximum D")
	{
	R_Date("QL-4881", 1159, 14);
	R_Date("Beta-221634", 1140, 50);
	R_Date("Beta-95912", 1090, 60);
	R_Date("Beta-36046", 1050, 70);
	R_Date("Beta-110746", 1010, 50);
	};
	Boundary("earthquake D interval");
	Phase("minimum D")
	{
	R_Date("Beta-29145", 1170, 90);
	R_Date("Beta-102336", 1140, 80);
	R_Date("QL-4658", 1132, 17);
	R_Date("Beta-86419", 1130, 50);
	R_Date("3-age mean", 1100, 19);
	R_Date("Beta-110150", 1030, 70);
	R_Date("Beta - 175551", 1040, 40);
	};
	Boundary("minimum D");
	};
	};
		Earthquake Dsme - Saddle Mountain East fault
		Plot()
		{
		Sequence(earthquake Dsme interval SM East fault)
		{
		Boundary("maximum E");
		Phase("maximum E")
		{
		R_Date("Hughesb", 1210, 35);
		R_Date("Wilson", 1155, 85);
		R_Date("Hughesa", 1150, 40);
		};
		Zero_Boundary("earthquake E zero");
		Boundary("Begin historical record", 1851 AD);
		};
		
		Earthquake Dsmw - Saddle Mountain West fault
		Plot()
		{
		Sequence(earthquake Dsmw interval SM West fault)
		{
		Boundary("maximum D?");
		Phase("maximum D")
		{
		R_Date("Hughes", 1210, 40);
		};
		Boundary("earthquake Dsmw interval");
		R_Date("32081", 1120, 35);
		Boundary("minimum Dsmw");
		};
		};

```
  R_Date("OS-25852", 1300, 21);
  R_Date("OS-27359", 1230, 30);
  };
  Boundary("minimum C");
 };
};
```

Earthquake D

```
Plot()
{
Sequence(earthquake D interval Sfz)
  {
   Boundary("maximum D");
   Phase("maximum D")
   {
    R_Date("OS-33852", 1181, 26);
    R_Date("Beta-125831", 1160, 50);
    R_Date("OS-80891", 1150, 30);
    R_Date("OS-33840", 1117, 26);
    R_Date("OS-78396", 1100, 25);
    R_Date("GX-16226", 1081, 66);
    R_Date("OS-23309", 1060, 30);
   };
   Boundary("earthquake D interval");
   Phase("minimum D")
   {
    R_Date("CAMS-101655", 1005, 40);
    R_Date("Beta-137175", 980, 80);
    R_Date("CAMS-101656", 925, 40);
   };
   Boundary("minimum D");
  };
 };
```

Earthquake E

```
Plot()
 {
  Sequence(earthquake E interval Sfz)
  {
   Boundary("maximum E");
   Phase("maximum E")
   {
    R_Date("CAMS-101657", 1025, 40);
    R_Date("CAMS-101655", 1005, 40);
    R_Date("OS-33841", 1000, 40);
    R_Date("CAMS-101656", 925, 40);
   };
   Zero_Boundary("earthquake E zero");
   Boundary("Begin historical record", 1851 AD);
  };
 };
```

OxCal version 4.1; methods of Bronk Ramsey (1995; 2009). Ages used in these OxCal models are listed in bold on Table 1 in the paper.

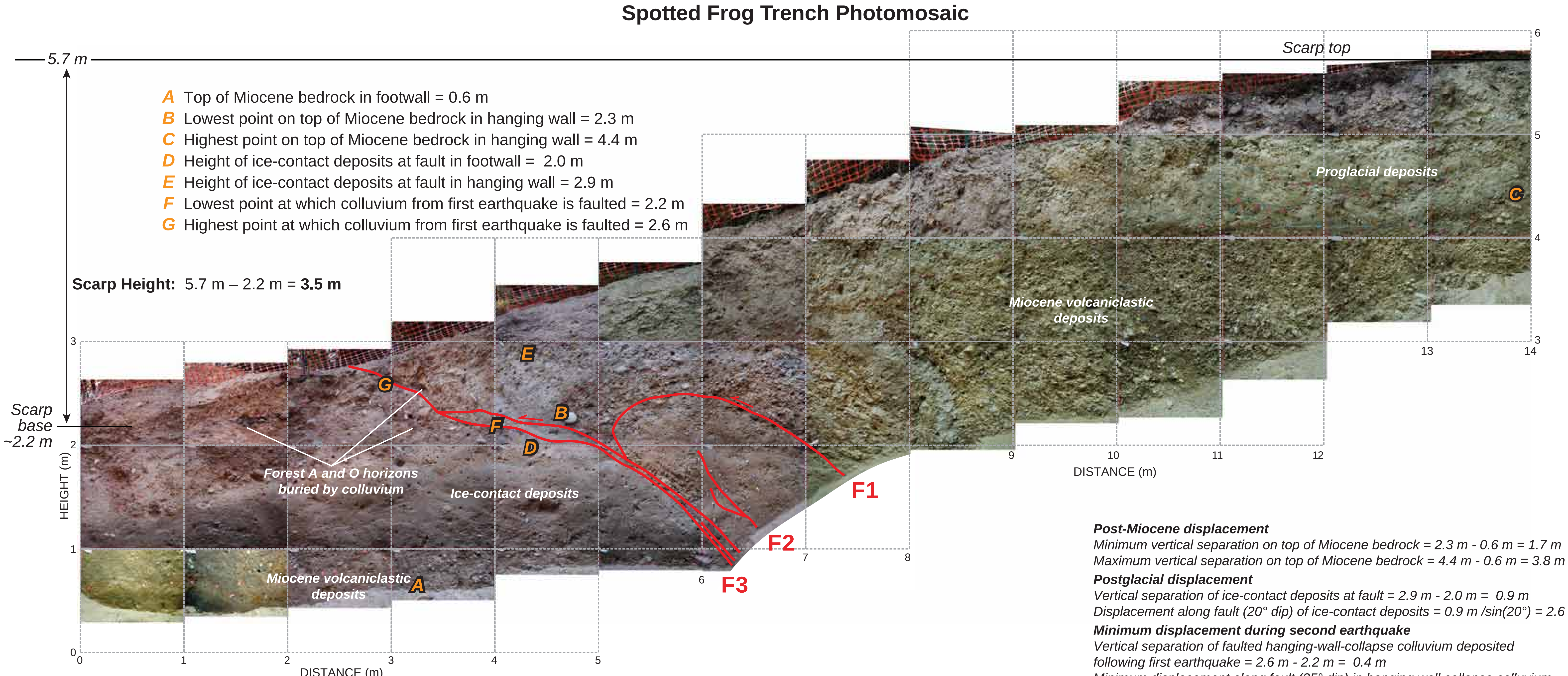

Fig. S1. Photomosaic of west wall of the Spotted Frog trench, IslandWood scarp, Bainbridge Island, showing measurements of scarp height, vertical separation of units, and displacement along the fault. The minimum amount of fault slip during the second event is indicated by the extent of the fault through the hanging-wall-collapse colluvium deposited during the first event (>0.9 m). If two surface-faulting events occurred since deposition of the ice-contact deposits, as suggested by stratigraphic relations, then the maximum slip during the first event equals the difference (<1.7 m) between the (minimum) second event slip (>0.9 m) and the total postglacial slip (2.6 m). The height of the scarp (3.5 m) suggests that additional displacement across the fault at depth has been taken up by folding of the bedrock and ice-contact deposits during one or both earthquakes.

Figure S2
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23Apr14

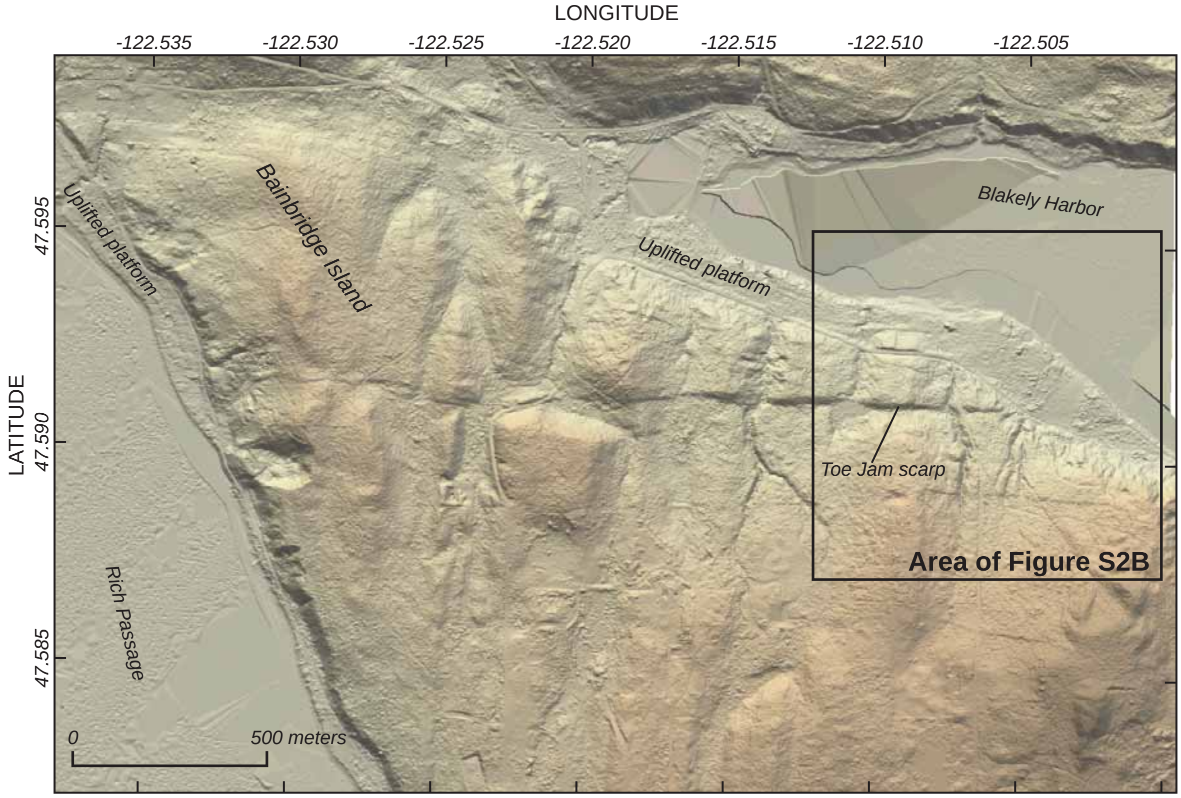

Fig. S2A. LiDAR image of southern Bainbridge Island showing uplifted platform, Toe Jam Hill fault scarp, and box outlining the location of an enlarged LiDAR image of the eastern end of the Toe Jam Hill scarp shown in Figure A2b.

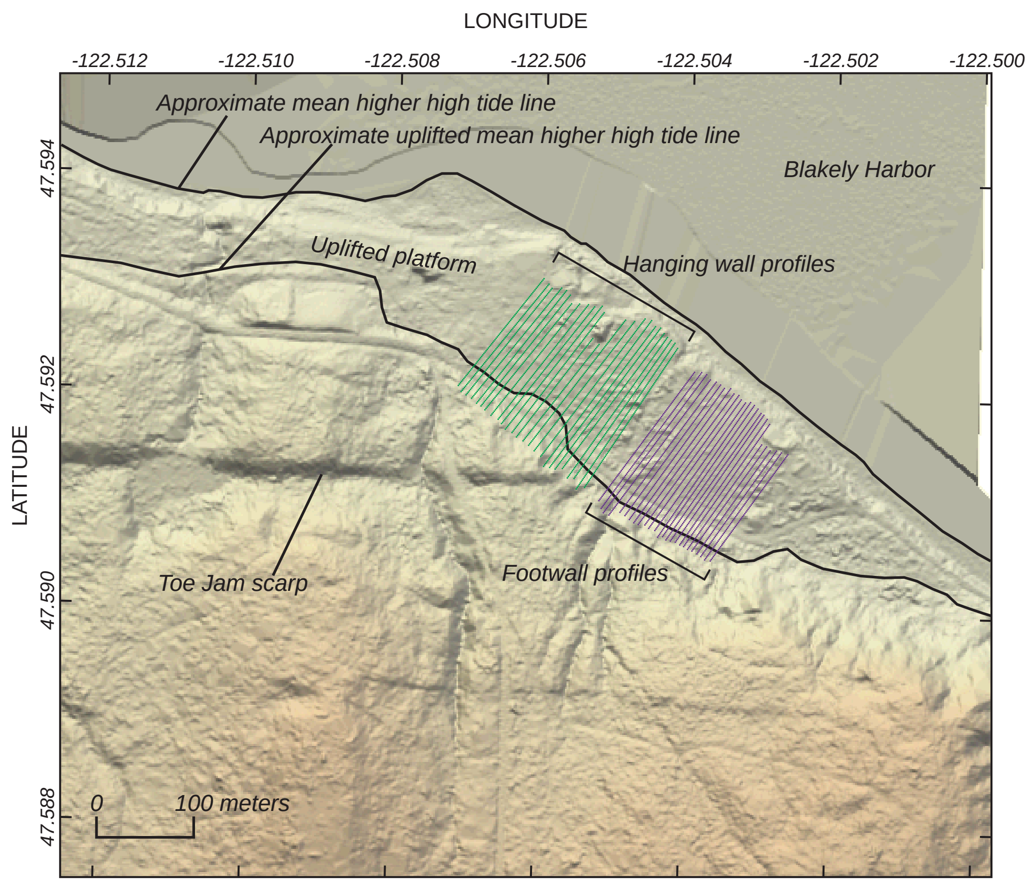

Fig. S2B. Enlarged LiDAR image of the eastern end of the Toe Jam Hill fault scarp where the scarp encounters the shoreline angle of the uplifted marine terrace. Rows of small green and purple dots indicate points along profiles used in the analysis (each row of dots equals one profile). Green dots trace profiles on the hanging wall, north of our projection of the scarp onto the terrace. Purple dots trace footwall profiles. Black line near southeast ends of profiles shows the approximate position of the shoreline angle of the terrace.

Figure S3
Nelson et al.
24Apr14

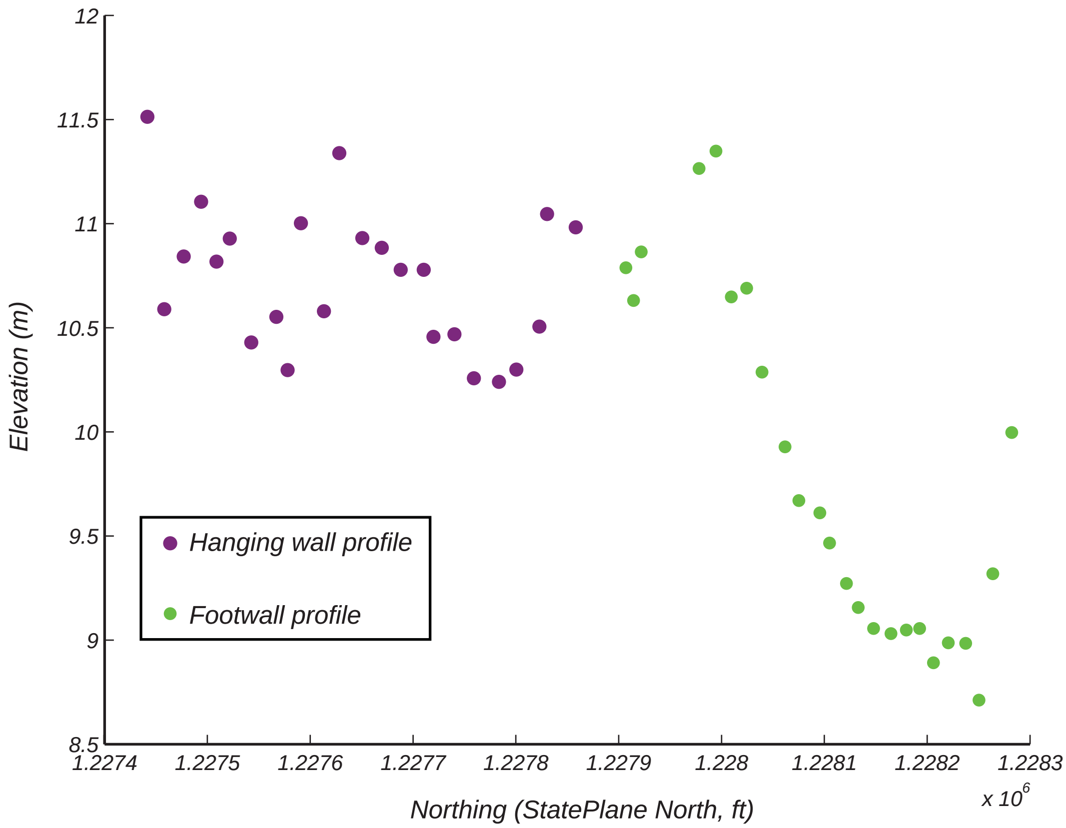

Figure S3a. Plot of calculated elevations of uplifted shoreline angles on the uplifted platform across the Toe Jam Hill fault shown on Figure S2b. Green dots are shoreline angles on hanging wall profiles and purple dots are shoreline angles on footwall profiles. Elevations of shoreline angles on the hanging wall are higher than those on the footwall.

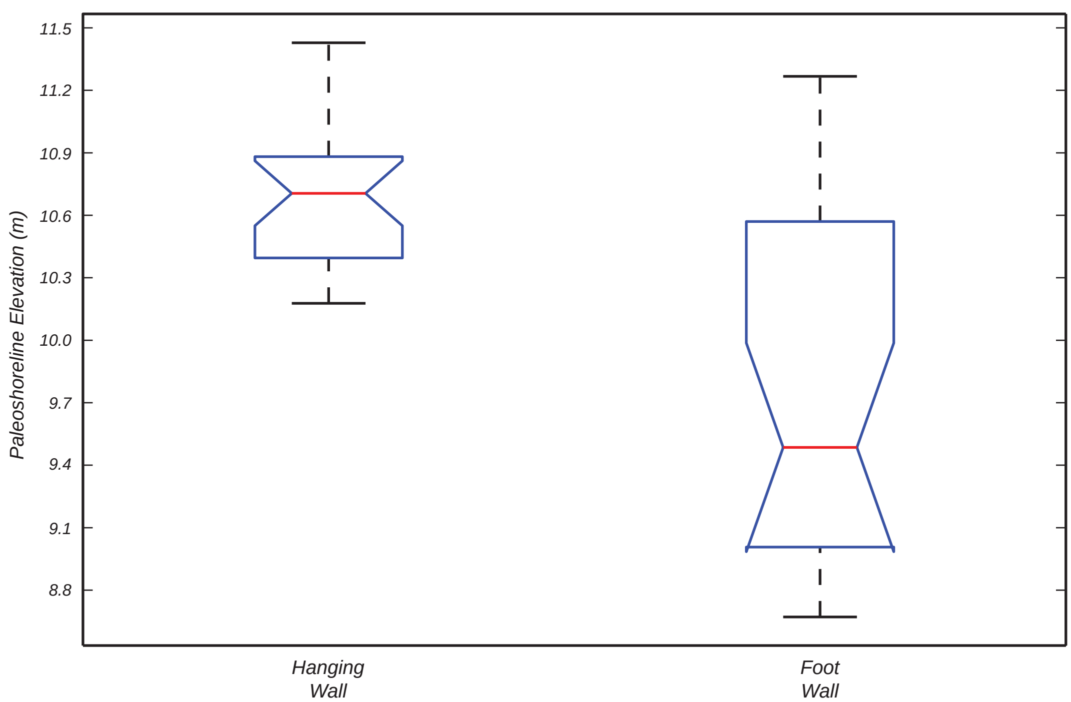

Figure S3b. Notched boxplots of shoreline angle elevations on the footwall and hanging wall on either side of our projection of the Toe Jam Hill fault onto the uplifted marine terrace. The notches do not overlap, indicating a significant difference in median shoreline angle elevations across the projection of the fault. A paired t-test on means of measured paleo-shorelines (separate hanging wall and footwall populations, n=24 each) rejects the null hypothesis that there is no difference in paleoshoreline elevation across the projection of the fault at east end of the Toe Jam Hill scarp (at a significance level of $p < 0.05$). The notched boxplot shows that median elevations differ significantly across the fault projection.

Figure S4
Nelson et al.
23Apr14

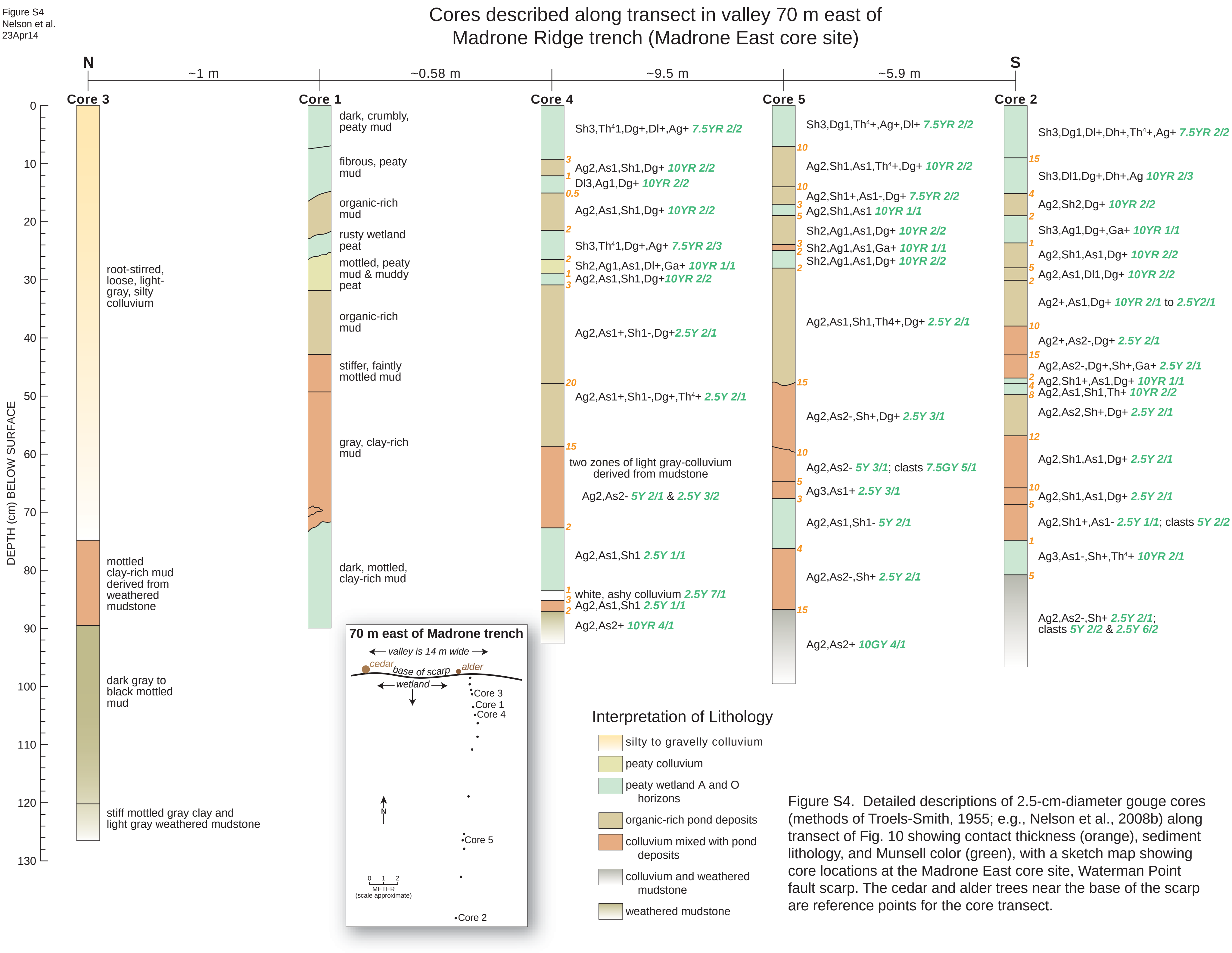

Figure S4. Detailed descriptions of 2.5-cm-diameter gouge cores (methods of Troels-Smith, 1955; e.g., Nelson et al., 2008b) along transect of Fig. 10 showing contact thickness (orange), sediment lithology, and Munsell color (green), with a sketch map showing core locations at the Madrone East core site, Waterman Point fault scarp. The cedar and alder trees near the base of the scarp are reference points for the core transect.

Figure S5
Nelson et al.
23Apr14

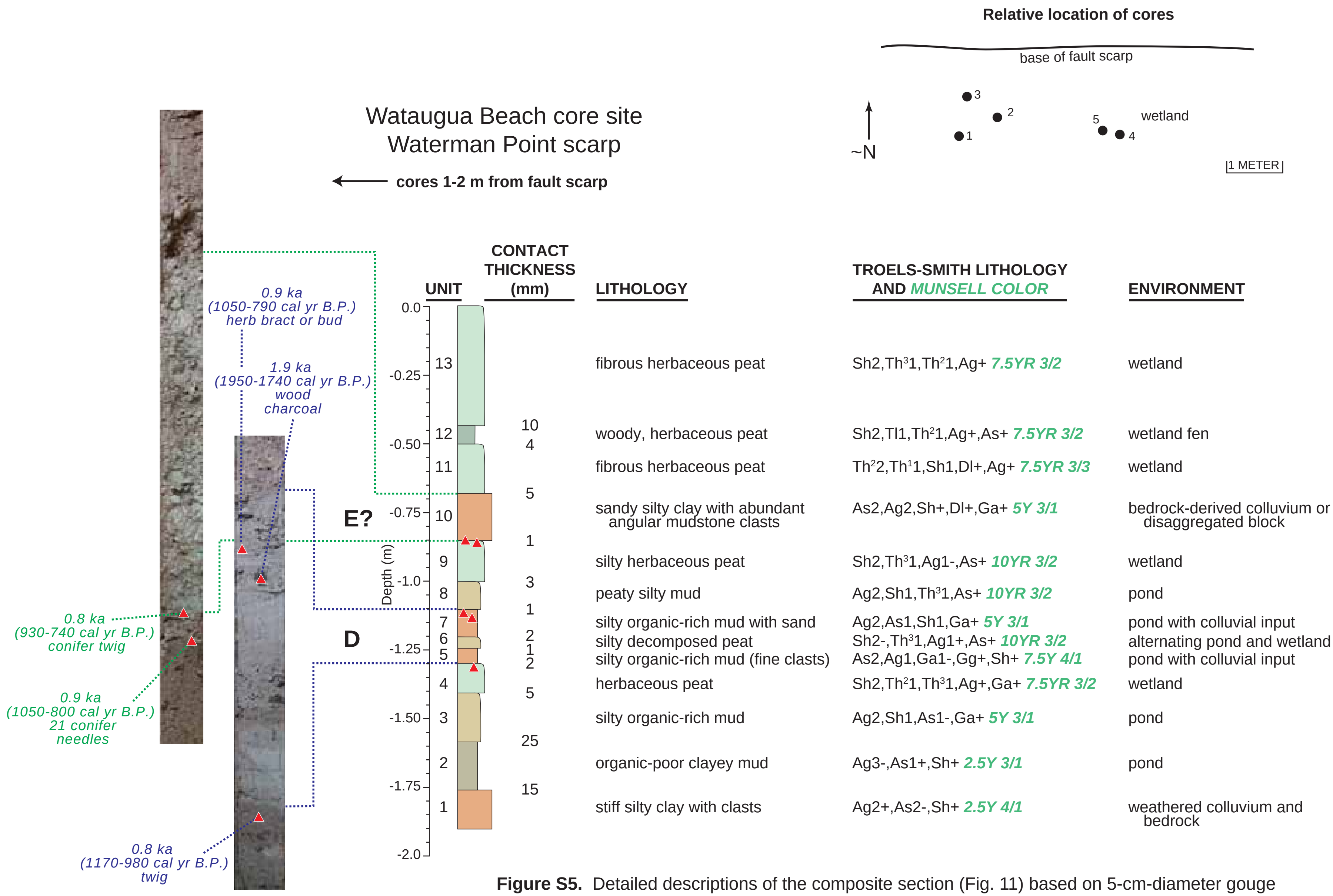

Figure S5. Detailed descriptions of the composite section (Fig. 11) based on 5-cm-diameter gouge cores (methods of Troels-Smith, 1955; e.g., Nelson et al., 2008b) used at the Wataugua Beach core site, Waterman Point fault scarp. Contact thickness, sediment lithology, Munsell color (green), and interpretation of environment is shown with a sketch map of core locations.

Figure S6
Nelson et al.
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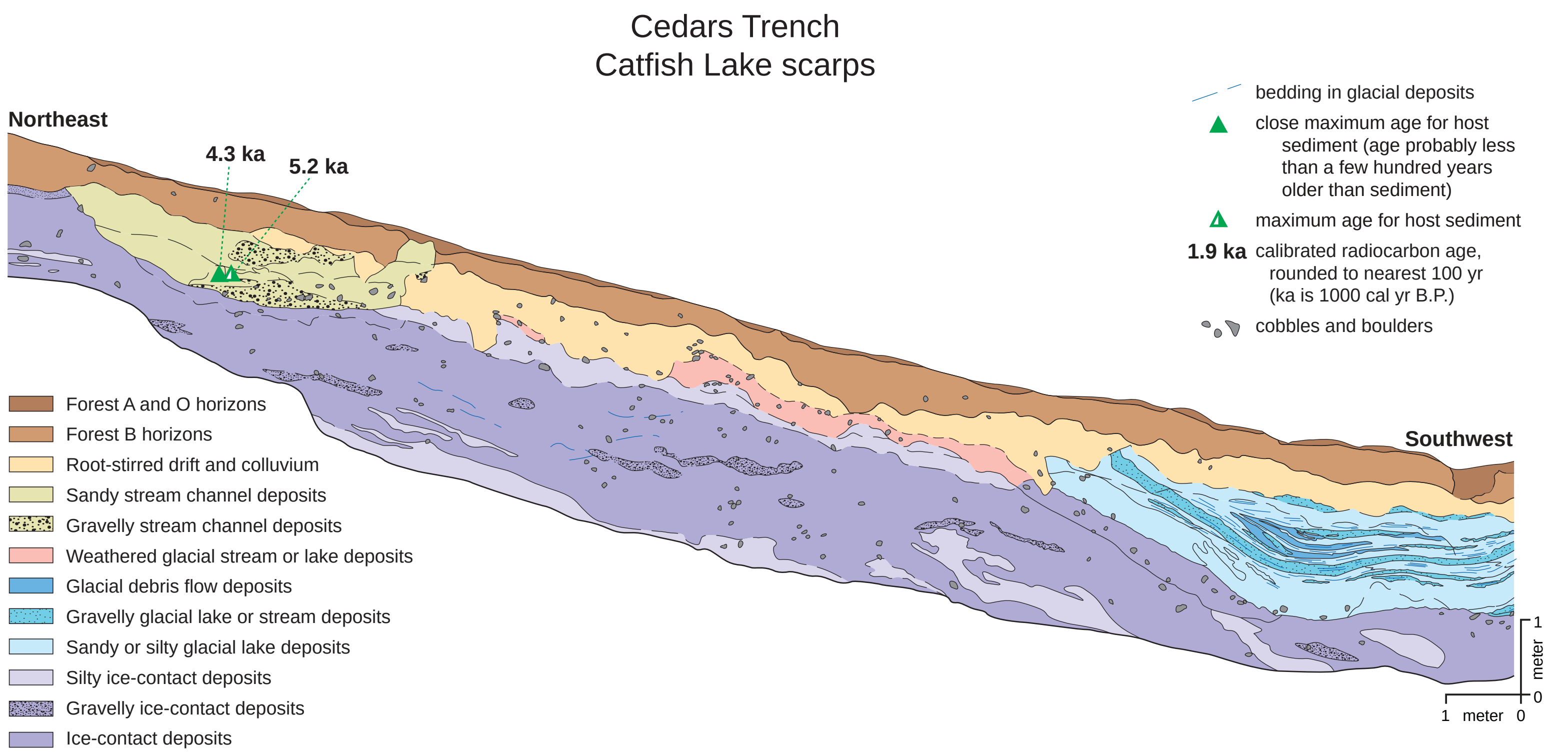
A)



B) Sequence of events

1 Deposition of subglacial ice-contact deposits followed by deposition of subglacial to proglacial stream, lake, and debris flow deposits (about 120-110 ka).
2 Deformation and folding of saturated subglacial and proglacial deposits by overlying or nearby ice during or shortly after deposition.
3 Development of a forest soil with a structural B horizon on the surficial and fluvial proglacial deposits, followed by extensive root stirring (postglacial through middle Holocene).
4 Erosion of the ice-contact deposits and the soil developed on them by a small stream with deposition of sandy and gravelly stream deposits in a 5-m-wide channel near the crest of the present-day scarp (after 4.3 ka).
5 Continued development of a forest soil on the subglacial and proglacial deposits and late Holocene stream deposits (after 4.3 ka).
6 Folding of the subglacial and proglacial deposits and stream deposits to form a 23-m-wide, 6.2-m-high scarp during slip on a blind thrust beneath the scarp, probably during multiple earthquakes (late Holocene).
7 Continued forest soil development with extensive root stirring above, on, and below the scarp (late Holocene).

Figure S6. Fault scarp stratigraphy, ages, and interpretation for the Cedars trench, Catfish Lake scarps, hanging wall of Tacoma fault (Figs. 1C and 2B). A) Central three-quarters of northeast wall of Cedars trench [m-1 to m19 on trench wall grid of Nelson et al., 2008a, http://pubs.er.usgs.gov/usgspubs/sim/sim3060]. B) Sequence of depositional and folding events in the trench. A thermoluminesence age of 110-119 ka on silt-sized feldspar from one of the lake beds (2.5 m southeast of right edge of figure) shows that folding considerably predates the last glacial maximum. Alan Nelson, Jason Buck, Steve Personius, Harvey Kelsey, Rob Witter, Rich Koehler, and Lee-Ann Bradley described, sampled, and interpreted the trench.