APPENDIX A

DESCRIPTION OF STRATIGRAPHIC UNITS IN TRENCHES AT THE PENROSE DRIVE TRENCH SITE

Unit, genesis[1]	Station no. (trench)[2]	Textural name[3]	Texture (%)[4]				Clasts		Plast-icity	Density/ consistency	Cemen-tation	HCL reaction	Clast ang.	Bedding	Structure	Sorting	Lower bound.[5]	Color[6] dry (moist)	Notes
			F	S	G	C/B	Largest (cm)	Average (cm)											
Stratigraphic Units																			
1, S & DF	10.8, 8.9 (W)	silty gravel with sand & cobbles	15	15	60	10	46	1-5	low	med-high	weak-mod	mod-strong	ang.-subang.	mod. well strat.	variable	variable	not exp.	*7.5YR6/4 (7.5YR4/6)*	Pre-Bonneville alluvial-fan deposits
2, L	32.7, 1.4 (W)	slightly sandy silt with minor clay and rare pebbles	95	4	<1	0	2	0.5	med	firm	none	mod	subang-subround	mottled & bioturbated	matrix	well	not exp.	*10YR6/6 (10YR5/6)*	Lake Bonneville highstand silt; slightly sticky when wet
3, L	29.6, 1.8 (W)	boulder gravel with minor sand	1	6	18	75	40-50	20-25	none	med	mod-strong	strong	subround-round	massive	clast	variable	abrupt, smooth	*10YR5/4 (10YR4/5)*	Provo-phase shorezone deposits
4, C	7.6, 2.1 (E)	boulder gravel with silt and sand	25	15	20	40	65	5-15	low	low-high	none-weak	mod-strong	subround-round	variable	variable	poor	clear	*10YR6/4 (10YR4/5)*	Scarp-derived colluvium
5, C	22.3, 4.4 (W)	sandy silty gravel with cobbles	32	8	40	20	25-30	3-5	med	med	none	mod	subang-subround	variable	maxtrix	poor	clear	*7.5YR6/4 (7.5YR4/6)*	Scarp-derived colluvium; clast-supported near fault zone
6, C	22.6, 4.8 (W)	sandy silty gravel with cobbles	30	10	35	25	10-15	5-8	med	med	none	mod	subang-subround	variable	matrix	poor	gradual	*7.5YR6/3 (7.5YR4/6)*	Scarp-derived colluvium. Near fault zone: clast supported with aligned cobbles
7, C	22.9, 5.5 (W)	sandy silt with gravel	40	15	35	10	10-15	4-6	med	low-med	none	mod	ang-subround	variable	matrix	poor	gradual	*7.5YR6/3 (7.5YR4.5/4)*	Scarp-derived colluvium
8, C	21.9, 6.2 (W)	sandy silt with gravel and rare cobbles	45	10	35	10	24	2-5	med	low-med	none	mod	ang-subround	variable	matrix	poor	gradual	*7.5YR7/3 (7.5YR5/4)*	Scarp-derived colluvium
9, F	25.3, 5.8 (W)	gravelly silt with sand and cobbles	40	15	40	5	40	2-6	med	loose-low	none	mod-strong	subang-subround	nonstrat-poorly strat.	matrix	poor	clear, smooth	*7.5YR5/4 (7.5YR4/3.5)*	Cultural fill with metal fragments
Soils																			
S1(3)	27.6, 2.5 (W)	sand with gravel and silt	5	65	20	10	25	5	low	med	none-weak	mod	subang-round	nonstrat	matrix	poor	clear-gradual	*(7.5YR3/2-3)**	A horizon with weak granular structure; local carbonate filaments; minor bioturbation; developed in Provo shoreline gravel (unit 3)
S1(4)	6.75, 2.25 (E)	sand with gravel and fines	10	45	35	10	16	4-5	none-low	med	none	strong	subang	nonstrat	matrix	poor	clear-gradual	*(7.5YR3/3)**	A horizon developed on unit 4 (scarp colluvium); locally contains carbonate filaments
S2	6.5, 2.7 (E)	sand with gravel and silt	10	50	30	10	13	3	low	med-high	none	mod-strong	subang-subround	nonstrat	matrix	poor	gradual	*(7.5YR3/4)**	A horizon with granular structure developed on unit 5; minor carbonate filaments; locally very fine grained.
S3	23.9, 4.7 (W)	silty sand with gravel	15	55	20	10	15	5	med	low	none	mod	ang-subang	nonstrat	matrix	poor	gradual-diffuse	*(7.5YR3/4)**	A horizon with weak granular structure developed on unit 6; abundant carbonate filaments.
S4	7.5, 5.05 (E)	gravel with sand and silt	25	30	40	5	8	2	med	low-med	none	mod-strong	ang-subang	nonstrat	matrix	poor	diffuse	*(7.5YR3/4)**	Weak A horizon (no soil structure) developed on unit 8; locally bioturbated and overprinted by S5

S5	26.15, 4.6 (W)	gravel with fines and sand	25	25	45	5	17	1-2	med	low	none	none-weak	ang-subang	nonstrat	matrix	poor	clear-diffuse	*(7.5YR2/2)**	A horizon with granular structure developed on several units; carbonate accumulation at 10-20 cm; locally very organic
S6(9)	26.85, 5.75 (W)	gravel with sand and silt	10	40	45	5	10	1-2	med	loose	none	mod	ang	nonstrat	variable	poor	gradual-diffuse	*(7.5YR3/4)**	A horizon with granular structure developed on unit 9 (hanging wall); bioturbated
S6(1)	5.9, 10.95 (W)	silty sand with gravel and organic debris	18	50	30	2	7	2	low	loose	none	weak	ang-subround	nonstrat	matrix	poor	abrupt	*(7.5YR2/2)**	A horizon with granular structure developed on unit 1 (footwall); biotrubated
S6(1) 2Bk	5.9, 10.75 (W)	sand with gravel and silt	5	55	30	10	15	2-3	low	med-high	mod	strong	subang-subround	nonstrat	matrix	poor	clear-diffuse	*(7.5YR4/4)**	Carbonate soil horizon (stage II-III?) developed on unit 1; carbonate throughout matrix--though variable; locally well cemented with weak horizonatal laminations; most clasts completely coated; rinds <2 mm thick and diffuse (poorly laminated)

[1] Units correspond with plate 1. Genesis: S - stream, DF - debris flow, L - lacustrine, C - colluvium, F - fill. For soils (S1-S6), number in parentheses is unit soil is developed on (where described).

[2] Horizontal and vertical meters correspond to plate 1; (W) - west trench, (E) - east trench.

[3] Texture terms based on the Unified Soil Classification System (density/consistency after Birkeland and others [1991]). Textural information may not be representative of entire unit due to vertical and horizontal heterogeneity in units.

[4] Percentages of clast-size fractions (based on area) are field estimates. We used a U.S. Standard #10 (2 mm) sieve to separate matrix from gravel.

[5] Lower boundary modified from Birkeland and others (1991). Distinctness: abrupt (1mm-2.5 cm), clear (2.5-6 cm), gradual (6-12.5 cm). Not exp. - base of unit not exposed.

[6] Munsell color of matrix (year 2000 revised version). * indicates dry color not recorded.

Appendix B

Examination of Bulk Soil for Radiocarbon Datable Material and Extraction of Microcharcoal from the Penrose Drive Trench Site, East Bench Fault, Salt Lake City, Utah

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INTRODUCTION

A total of eleven bulk soil samples, three charcoal samples, and two shell samples were examined for the presence of organic material suitable for radiocarbon analysis. These samples were recovered from two trenches at the Penrose Drive site in Salt Lake City, Utah. Botanic components and detrital charcoal were identified, and potentially radiocarbon datable material was separated. Dating of material from the trenches will be used to help develop detailed information on the timing and recurrence of paleoearthquakes on the Salt Lake City segment of the Wasatch Fault zone. Samples for AMS radiocarbon dating will be submitted to Woods Hole Institute.

METHODS

Flotation and Identification

The macrofloral samples were floated using a modification of the procedures outlined by Matthews (1979). Each sample was added to approximately 3 gallons of water, then stirred until a strong vortex formed. The floating material (light fraction) was poured through a 150 micron mesh sieve. Additional water was added and the process repeated until all floating material was removed from the sample (a minimum of five times). The material that remained in the bottom (heavy fraction) was poured through a 0.5-mm mesh screen. The floated portions were allowed to dry.

The light fractions were weighed, then passed through a series of graduated screens (US Standard Sieves with 2-mm, 1-mm, 0.5-mm and 0.25-mm openings) to separate charcoal debris and to initially sort the remains. The contents of each screen then were examined. Charcoal pieces larger than 2-mm, 1-mm, or 0.5-mm in diameter were separated from the rest of the light fraction and the total charcoal weighed. A representative sample of charcoal pieces was broken to expose fresh cross, radial, and tangential sections. Charcoal fragments were examined under a binocular microscope at a magnification of 70x and under a Nikon Optiphot 66 microscope at magnifications of 320-800x. The weights of each charcoal type within the representative sample also were recorded. The material that remained in the 2-mm, 1-mm, 0.5-mm, and 0.25-mm sieves was scanned under a binocular stereo microscope at a magnification of 10x, with some identifications requiring magnifications of up to 70x. The material that passed through the 0.25-mm screen was not examined. The heavy fractions were scanned at a magnification of 2x for the presence of botanic remains. Remains from the light and heavy fractions were recorded as charred and/or uncharred, whole and/or fragments. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules.

Charcoal fragments in the three charcoal samples were broken to expose fresh cross, radial, and tangential sections, then examined under a binocular microscope at a magnification of 70x and under a Nikon Optiphot 66 microscope at magnifications of 320-800x. The weights of each charcoal type were recorded. The two shell samples were water-screened through a 250 micron mesh and allowed to dry. Shell fragments were separated from the rest of the sample matrix and weighed. Macrofloral remains, including charcoal, are identified using manuals (Carlquist 2001; Hoadley 1990; Martin and Barkley 1961; Musil 1963; Panshin and de Zeeuw 1980; Schopmeyer 1974) and by comparison with modern and archaeological references. Because charcoal and possibly other botanic remains were to be submitted for radiocarbon dating, clean laboratory conditions were used during flotation and identification to avoid contamination. All instruments were washed between samples, and samples were protected from contact with modern charcoal.

Microcharcoal Recovery

Now it is possible to recover microscopic charcoal (microcharcoal) from sediments for the purpose of obtaining an AMS radiocarbon age. Microscopic charcoal fragments are far superior to humates because they provide dates with the same precision as those obtained from larger pieces of charcoal, with the single exception that the individual pieces of microscopic charcoal are not identified to taxon.

A chemical extraction technique based on that used for pollen, and relying upon heavy liquid extraction, has been modified to recover microcharcoal for the purpose of obtaining an AMS radiocarbon age. After removing calcium carbonates and iron with hydrochloric acid (10%), the samples were screened through 150 micron mesh. The material remaining in the screen was examined for the presence of macroscopic charcoal. Since an the amount of macroscopic charcoal was insufficient for obtaining a radiocarbon date, the screened samples then were rinsed until neutral, and a small quantity of sodium hexametaphosphate was added. Samples then were filled with reverse osmosis, deionized (RODI) water and allowed to settle according to Stoke's Law. After two hours the supernatant, containing clay, was poured off and the sample was rinsed with RODI water three more times, being allowed to settle according to Stoke's Law after each rinse to remove more clays. Once the clays had been removed, the samples were freeze-dried using a vacuum system, freezing out all moisture at -98 °C. Sodium polytungstate (SPT), with a density of 1.8, was used for the flotation process. The samples were mixed with SPT and centrifuged at 1500 rpm for 10 minutes to separate organic from inorganic remains. The supernatant containing pollen, organic remains, and microcharcoal was decanted. Sodium polytungstate again was added to the inorganic fraction to repeat the separation process until all visible microcharcoal had been recovered. The microcharcoal was recovered from the sodium polytungstate and rinsed thoroughly with RODI water. Following this step, the samples were examined using a binocular microscope at a magnification of up to 30x to check the matrix for microscopic charcoal and other debris. Each sample received a treatment with hot nitric acid (30%) for 30 minutes to remove extraneous debris. RODI water rinses followed, with another examination with the binocular microscope. The nitric acid treatments continued until examination of the samples using the binocular microscope indicated that all that remained was microcharcoal and feldspar. Feldspar and other microminerals cannot be removed from microcharcoal samples, however, the presence of these minerals will not affect the date that is obtained.

DISCUSSION

The two trenches at the Penrose Drive trench site crossed the East Bench fault of the Salt Lake City segment of the Wasatch fault zone. The trench site is noted to lie below the highest shoreline of Lake Bonneville and at the approximate elevation of the of the Provo shoreline. The trenches exposed pre-Bonneville alluvial-fan deposits, fine-grained Lake

Bonneville sediments related to the Bonneville highstand, a boulder gravel at the Provo shoreline, and fault-scarp-derived colluvium (Christopher DuRoss, personal communication, June 3, 2010). Excavation of the trenches yielded evidence for five (P1-P5) and possibly six surface-faulting earthquakes that occurred after abandonment of the Provo shoreline at around 14,000 B.P. The bulk soil samples and two of the charcoal samples were recovered from soils (S1-S5) developed between earthquakes on the fault-scarp-derived colluvium. One of the charcoal samples and the two shell samples were recovered from soils developed on the Provo boulder gravel.

Bulk samples PD-R12 and PD-R11 were recovered from soil S5 developed on distal P2 and P1 colluvium (Table 1). Sample PD-R12 contained three small fragments of *Artemisia* charcoal weighing 0.0010 g, three small fragments of hardwood charcoal too small for further identification weighing 0.0006 g, and unidentified charcoal weighing 0.0033 g (Table 2, Table 3). A few charred Poaceae C caryopses and unidentified seeds also were noted. Poaceae C caryopses reflect grasses with small seeds, such as *Agrostis* (bentgrass), *Muhlenbergia* (muhly grass), *Poa* (bluegrass), etc. Four pieces of charred, vitrified tissue weighing 0.0002 g may represent charcoal or other charred plant tissue with a shiny, glassy appearance due to fusion by heat. A few uncharred seeds and an uncharred hardwood wood fragment represent modern plants in the area. In addition, the sample contained several insect chitin fragments and a single snail shell with a depressed (flat) shape where the width is much bigger than the height.

A single piece of *Quercus* charcoal weighing 0.0010 g was present in sample PD-R11, as well as several fragments of hardwood charcoal too small for further identification weighing 0.0005 g. Components of the local vegetation are represented by a single uncharred *Descurainia* seed, a few root fragments, and several rootlets. Non-floral remains include an uncharred bone fragment, a few insect chitin fragments, and a few insect puparium fragments.

Samples PD-R14 and PD-R9 were collected from soil S4 developed on P2 colluvium in Unit 7. Seven fragments of hardwood charcoal too small for identification and weighing 0.0004 g were present in sample PD-R14. The sample also contained a single piece of charred vitrified tissue weighing 0.0001 g. In addition, the sample contained a few depressed snail shells and several snail shell fragments. Due to the small weight of charred material recovered in the sample, additional sediment was processed to recover microscopic charcoal for dating. Examination of the microcharcoal screen contents yielded an additional 0.0002 g of unidentified hardwood charcoal. A total of 0.0102 g of microcharcoal with about 30% feldspar was extracted (Table 4).

Sample PD-R9 yielded four fragments of hardwood charcoal too small for further identification weighing 0.0003 g. Additional sediment was processed to recover microcharcoal, resulting in 0.0022 g of microscopic charcoal (with about 60% feldspar) for dating. The sample also yielded a few uncharred rootlets from modern plants, an insect chitin fragment, an insect egg fragment, and a few depressed snail shells.

Samples PD-R10, PD-R8, and PD-R5 were taken from soil S3 developed on P3 colluvium in Unit 6. Sample PD-R10 contained a charred *Prunus*-type seed fragment weighing 0.0005 g suggesting the presence of a wild cherry in the area. In addition, the sample contained three fragments of charred parenchymous tissue weighing 0.0006 g and eight pieces of hardwood charcoal too small for further identification weighing 0.0002 g. Parenchyma is the botanical term for relatively undifferentiated tissue, composed of many similar thin-walled cells.

Parenchyma occurs in many different plant organs in varying amounts, especially large fleshy organs such as roots and stems. The vegetative storage parenchyma in roots and stems stores starch and other carbohydrates and sugars (Hather 2000:1). Recovery of charred parenchymous tissue might reflect burned root or stem tissue. Non-floral remains include an uncharred bone fragment, a moderate amount of insect eggs, a few depressed snail shells, and several snail shell fragments. Additional sediment also was processed to recover microcharcoal, and a total of 0.0029 g of microcharcoal (containing about 30% feldspar) was recovered.

A total of six pieces of hardwood charcoal too small for further identification weighing 0.0002 g were present in sample PD-R8, as well as a few uncharred rootlets from modern plants and a snail shell fragment. Additional soil was processed to recover microscopic charcoal, and an additional 0.0017 g of microcharcoal was obtained. Of this amount, about 30% was feldspar.

Sample PD-R5 contained several fragments of hardwood charcoal too small for further identification weighing 0.0005 g, as well as three small pieces of charred parenchymous tissue weighing 0.0001 g. A few uncharred rootlets from modern plants, an insect chitin fragment, a moderate amount of insect eggs, several snail shells with a depressed shape, and a moderate amount of snail shell fragments also were noted. Additional soil processed to recover microscopic charcoal yielded only 0.0003 g of microcharcoal, 50% of which was feldspar.

Samples PD-R15 and PD-R6 represent soil S2 developed on P4 colluvium in Unit 5. Pieces of hardwood charcoal too small for further identification and weighing 0.0012 g were present in sample PD-R15. A piece of charred parenchymous tissue weighing 0.0003 g and three fragments of charred vitrified tissue weighing 0.0002 g also were recovered. In addition, the sample contained several snail shells with a depressed shape and a moderate amount of snail shell fragments.

Sample PD-R6 yielded several fragments of unidentified hardwood charcoal weighing 0.0029 g and six pieces of small, vitrified charcoal from a twig fragment weighing 0.0031 g. The sample also yielded a few charred seeds and several uncharred *Celtis* seed fragments. Uncharred seeds normally are interpreted to represent components of modern or historic vegetation. However, *Celtis* seeds undergo natural mineralization (biomineralization) over time and contain large quantities of calcium carbonate, which makes them resilient to decomposition. As a result, uncharred *Celtis* seeds can survive in old deposits without other means of outside preservation, such as charring (Zohary and Hopf 2000). Non-floral remains in this sample include two uncharred bone fragments, fifteen depressed snail shells, a moderate amount of snail shell fragments, and an oblong snail shell where the height is much bigger than the width.

A charcoal sample and two snail shell samples were collected from soil S1 developed on the Provo boulder gravel. Charcoal sample PD-R2 yielded two fragments of probable Rosaceae charcoal weighing 0.0037 g and eight pieces of unidentified hardwood charcoal weighing 0.0012 g. Numerous snail shell fragments weighing 0.076 g were present in sample PD-R4. Sample PD-R16 contained several oblong snail shells and shell fragments weighing 0.757 g.

Bulk sample PD-R7 and charcoal samples PD-R1 and PD-R3 were recovered from soil S1 developed on P5 colluvium in Unit 4. Sample PD-R7 contained several fragments of hardwood charcoal too small for further identification weighing 0.0012 g, a vitrified piece of hardwood root charcoal weighing 0.0010 g, two fragments of vitrified hardwood twig fragments weighing 0.0007 g, and a small fragment of charcoal too vitrified for identification weighing less than 0.0001 g. In addition, the sample yielded two charred fragments of parenchymous tissue weighing 0.0005 g, a small charred and vitrified monocot/herbaceous dicot stem fragment weighing less than 0.0001 g, and a charred unidentified seed endosperm fragment. The sample also contained two uncharred bone fragments, an insect puparium, two depressed snail shells, and numerous snail shell fragments.

Eight fragments of hardwood charcoal too small and friable for further identification and weighing 0.0040 g were present in sample PD-R1. Pieces of hardwood charcoal weighing 0.0035 g also were noted in sample PD-R3.

Bulk sample PD-R13 from soil S1 possibly was developed on distal P5 colluvium in Unit 4. This sample contained seven fragments of hardwood charcoal too small for further identification weighing 0.0002 g and several fragments of charred parenchymous tissue weighing 0.0111 g. Non-floral remains include an insect chitin fragment, a depressed snail shell, and a moderate amount of snail shell fragments.

SUMMARY AND CONCLUSIONS

Flotation of sediment samples and identification of charcoal samples from two trenches at the Penrose Drive site in the Salt Lake City segment of the Wasatch Fault zone, Utah, resulted in recovery of charcoal and other charred botanic remains that can be submitted for radiocarbon analysis. Several samples contained charcoal or charred botanic remains in sufficient quantities for AMS radiocarbon dating. Five samples did not contain sufficient macroscopic charcoal for dating; therefore, the samples were processed to recover microscopic charcoal. Four of these samples yielded sufficient microcharcoal for dating. The majority of the charcoal fragments recovered from these samples consisted of hardwood charcoal too small for further identification. Fragments of identifiable *Artemisia* and *Quercus* charcoal in samples from the youngest S5 soil reflect sagebrush and oak in the area. A charred *Prunus*-type seed fragment in sample PD-R10 from soil S3 and pieces of probable Rosaceae charcoal in sample PD-R2 from the oldest S1 soil suggest the presence of a woody member of the rose family, such as chokecherry. Several samples contained pieces of charred parenchymous tissue, likely from burned root or stem tissue.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM THE PENROSE DRIVE TRENCH SITE,
SALT LAKE CITY, UTAH

Sample No.	Trench	Unit No.	Sample Location (horiz., vert.)	Provenience/ Description	Analysis
PD-R12	West	7, 8	28.9 m, 3.6 m	Bulk sample from soil S5 developed on distal P2 and P1 colluvium; minimum for P1	Macrofloral
PD-R11	West	7, 8	26.9 m, 4.2 m	Bulk sample from soil S5 developed on distal P2 and P1 colluvium; minimum for P1	Macrofloral
PD-R14	West	7	23.4 m, 5.5 m	Bulk sample from soil S4 developed on P2 colluvium; minimum for P2, maximum for P1	Macrofloral Microcharcoal
PD-R9	West	7	22.9 m, 5.6 m	Bulk sample from soil S4 developed on P2 colluvium; minimum for P2, maximum for P1	Macrofloral Microcharcoal
PD-R10	West	6	23.6 m, 4.8 m	Bulk sample from soil S3 developed on P3 colluvium; minimum for P3, maximum for P2	Macrofloral Microcharcoal
PD-R8	East	6	6.2 m, 3.5 m (west wall)	Bulk sample from soil S3 developed on P3 colluvium; minimum for P3, maximum for P2	Macrofloral Microcharcoal
PD-R5	East	6	5.6 m, 3.6 m	Bulk sample from soil S3 developed on P3 colluvium; minimum for P3, maximum for P2	Macrofloral Microcharcoal
PD-R15	West	5	25.1 m, 3.4 m	Bulk sample from soil S2 developed on P4 colluvium; minimum for P4, maximum for P3	Macrofloral
PD-R6	East	5	6.7 m, 2.8 m	Bulk sample from soil S2 developed on P4 colluvium; minimum for P4, maximum for P3	Macrofloral
PD-R2	West	3	31.2 m, 2.2 m	Charcoal from soil S1 developed on Provo boulder gravel; possible minimum age for P5	Charcoal ID
PD-R16	West	3	26.0 m, 2.6 m to 29.6 m, 2.0 m	Gastropod shells from Provo boulder gravel	Shell

TABLE 1 (Continued)

Sample No.	Trench	Unit No.	Sample Location (horiz., vert.)	Provenience/ Description	Analysis
PD-R4	West	3	24.9 m, 2.8 m	Gastropod shell fragments from soil S1 developed on Provo boulder gravel; possible minimum age for P5	Shell
PD-R7	East	4	6.6 m, 2.2 m	Bulk sample from soil S1 developed on P5 colluvium; minimum age for P5	Macrofloral
PD-R1	East	4	6.3 m, 2.0 m	Charcoal fragment from soil S1 developed on P5 colluvium; minimum age for event P5	Charcoal ID
PD-R3	East	4	7.4 m, 2.4 m	Charcoal from soil S1 developed on P5 colluvium; minimum age for P5	Charcoal ID
PD-R13	West	4	24.8 m, 3.0 m	Bulk sample from soil S1 possibly developed on distal P5 colluvium; possible minimum age for P5	Macrofloral

horiz. = horizontal
vert. = vertical
S1 = oldest soil
S5 = youngest soil
P1 = youngest prehistoric surface-faulting earthquake
P5 = oldest prehistoric surface-faulting earthquake

TABLE 2
MACROFLORAL REMAINS FROM THE PENROSE DRIVE TRENCH SITE, SALT LAKE CITY, UTAH

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
PD-R12	Liters Floated						0.85 L
Unit 7, 8	Light Fraction Weight						1.44 g
Soil S5	FLORAL REMAINS:						
	Poaceae C	Caryopsis	1				0.0001 g
	cf. Poaceae C	Caryopsis	1	2			0.0002 g
	Unidentified N	Seed	4	1			0.0004 g
	Vitrified tissue			4			0.0002 g
	Cheno-am	Seed				1	< 0.0001 g
	Medicago	Seed			1		0.0017 g
	Sambucus					1	0.0007 g
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Artemisia	Charcoal		3			0.0010 g
	Unidentified hardwood - small	Charcoal		3			0.0006 g
	Unidentified	Charcoal		X			0.0033 g
	Unidentified hardwood	Wood				1	0.0004 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				18	
	Rock/Gravel					X	Moderate
	Snail shell - depressed				1		0.0014 g

TABLE 2 (Continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
PD-R11	Liters Floated						0.70 L
Unit 7, 8	Light Fraction Weight						0.84 g
Soil S5	FLORAL REMAINS:						
	Descurainia	Seed			1		< 0.0001 g
	Roots					X	Few
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Quercus	Charcoal		1			0.0010 g
	Unidentified hardwood	Charcoal		21			0.0005 g
	NON-FLORAL REMAINS:						
	Bone - 0.05 mm					1	0.0018 g
	Insect	Insect				5	
	Insect	Puparium				3	
	Rock/Gravel					X	Moderate
PD-R14	Liters Floated						1.00 L
Unit 7	Light Fraction Weight						1.74 g
Soil S4	Microcharcoal Screen Content Weight						151.48 g
	FLORAL REMAINS:						
	Vitrified tissue > 0.25 mm			1			0.0001 g
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Unidentified hardwood - small	Charcoal		X			0.0006 g
	NON-FLORAL REMAINS:						
	Rock/Gravel					X	Moderate
	Snail shell - depressed, 0.05 mm				4	2	0.006 g
	Snail shell in heavy fraction					X	Moderate

TABLE 2 (Continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
PD-R9	Liters Floated						0.50 L
Unit 7	Light Fraction Weight						1.10 g
Soil S4	Microcharcoal Screen Content Weight						120.23 g
	FLORAL REMAINS:						
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 2 mm						
	Unidentified hardwood - small	Charcoal		4			0.0003 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				1	
	Insect	Egg			1		
	Rock/Gravel					X	Moderate
	Snail shell - depressed				4	1	0.0050 g
PD-R10	Liters Floated						0.80 L
Unit 6	Light Fraction Weight						0.82 g
Soil S3	Microcharcoal Screen Content Weight						107.30 g
	FLORAL REMAINS:						
	Parenchymous tissue			3			0.0006 g
	Prunus-type	Seed		1			0.0005 g
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 0.25 mm						0.0002 g
	Unidentified hardwood	Charcoal		8			0.0002 g
PD-R10	NON-FLORAL REMAINS:						
Unit 6	Bone					1	0.008 g
Soil S3	Insect	Egg			X		Moderate
	Rock/Gravel					X	Moderate
	Snail shell - depressed $\geq$ 1 mm					3	0.002 g
	Snail shell in heavy fraction				1	X	Moderate

TABLE 2 (Continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
PD-R8	Liters Floated						1.00 L
Unit 6	Light Fraction Weight						3.63 g
Soil S3	Microcharcoal Screen Content Weight						101.76 g
	FLORAL REMAINS:						
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Unidentified hardwood - small	Charcoal		6			0.0002 g
	NON-FLORAL REMAINS:						
	Rock/Gravel					X	Moderate
	Snail shell					1	0.005 g
PD-R5	Liters Floated						1.20 L
Unit 6	Light Fraction Weight						1.06 g
Soil S3	Microcharcoal Screen Content Weight						136.27 g
	FLORAL REMAINS:						
	Parenchymous tissue > 0.25 mm			3			0.0001 g
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Unidentified hardwood - small	Charcoal		24			0.0005 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				1	
	Insect	Egg			X		Moderate
	Rock/Gravel					X	Moderate
	Snail shell - depressed > 1 mm				5		0.006 g
	Snail shell - depressed > 0.5 mm				8	2	
	Snail shell in heavy fraction					X	Moderate

TABLE 2 (Continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
PD-R15	Liters Floated						1.20 L
Unit 5	Light Fraction Weight						1.62 g
Soil S2	FLORAL REMAINS:						
	Parenchymous tissue > 0.25 mm			1			0.0003 g
	Vitrified tissue > 0.25 mm			3			0.0002 g
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Unidentified hardwood - small	Charcoal		11			0.0012 g
	NON-FLORAL REMAINS:						
	Snail shell - depressed $\geq$ 1 mm				2	3	0.009 g
	Snail shell - depressed < 1 mm					10	
	Snail shell in heavy fraction					X	Moderate
PD-R6	Liters Floated						1.20 L
Unit 5	Light Fraction Weight						10.67 g
Soil S2	FLORAL REMAINS:						
	Cheno-am	Perisperm		2			< 0.0001 g
	Unidentified P	Seed	1				< 0.0001 g
	Celtis - outer	Seed coat				26	0.2692 g
	Celtis - inner	Seed coat			1		0.0213 g
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Total charcoal $\geq$ 0.5 mm						0.0080 g
	Unidentified hardwood	Charcoal		14			0.0029 g
	Unidentified twig - small, vitrified	Charcoal		6			0.0031 g
	NON-FLORAL REMAINS:						
	Bone					2	0.0035 g
	Rock/Gravel					X	Moderate
	Snail shell - depressed				15		0.0089 g
	Snail shell - oblong					1	0.0010 g
	Snail shell < 1 mm					X	Moderate

TABLE 2 (Continued)

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
PD-R2	Sample Weight						0.04 g
Unit 3	CHARCOAL/WOOD:						
Soil S1	cf. Rosaceae	Charcoal		2			0.0037 g
	Unidentified hardwood	Charcoal		8			0.0012 g
PD-R16	Water-screened Sample Weight						2.61 g
Unit 3	NON-FLORAL REMAINS:						
	Snail shell - oblong				13	65	0.757 g
	Sediment					X	1.853 g
PD-R4	Water-screened Sample Weight						0.43 g
Unit 3	NON-FLORAL REMAINS:						
	Snail shell					X	0.076 g
PD-R7	Liters Floated						0.80 L
Unit 4	Light Fraction Weight						7.05 g
Soil S1	Microcharcoal Screen Content Weight						122.24 g
	FLORAL REMAINS:						
	Unidentified	Endosperm		1			0.0001 g
	Monocot/Herbaceous dicot - vitrified	Stem		1			< 0.0001 g
	Parenchymous tissue $\geq$ 0.5 mm			2			0.0005 g
	Rootlets					X	Few
	CHARCOAL/WOOD:						
	Unidentified hardwood	Charcoal		21			0.0012 g
	Unidentified hardwood root - vitrified	Charcoal		1			0.0010 g
	Unidentified hardwood twig - small, vitrified	Charcoal		2			0.0007 g
	Unidentifiable - vitrified	Charcoal		1			< 0.0001 g

Sample No.	Identification	Part	Charred W	Charred F	Uncharred W	Uncharred F	Weights/ Comments
	NON-FLORAL REMAINS:						
	Bone > 0.5 mm					2	0.003 g
	Insect	Puparium			1		
	Rock/Gravel					X	Few
	Snail shell - depressed > 1 mm				2	1	0.008 g
	Snail shell < 1 mm					X	Numerous
	Snail shell in heavy fraction					X	Numerous
PD-R1	Sample Weight						0.53 g
Unit 4	CHARCOAL/WOOD:						
Soil S1	Total charcoal ≥ 2 mm						
	Unidentified hardwood - small, friable	Charcoal		8			0.0040 g
PD-R3	Sample Weight						2.27 g
Unit 4	CHARCOAL/WOOD:						
Soil S1	Unidentified hardwood	Charcoal		18			0.0035 g
PD-R13	Liters Floated						0.90 L
Unit 4	Light Fraction Weight						2.45 g
Soil S1	FLORAL REMAINS:						
	Parenchymous tissue > 0.25 mm - vitrified			74			0.0111 g
	CHARCOAL/WOOD:						
	Unidentified hardwood - small	Charcoal		7			0.0002 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				1	
	Rock/Gravel					X	Moderate
	Snail shell - depressed > 1 mm				1		0.001 g
	Snail shell in heavy fraction					X	Moderate

W = Whole
F = Fragment
X = Presence noted in sample
g = grams
mm = millimeters
L = liters

TABLE 3
INDEX OF MACROFLORAL REMAINS RECOVERED FROM THE PENROSE DRIVE TRENCH SITE, SALT LAKE CITY, UTAH

Scientific Name	Common Name
FLORAL REMAINS:	
Celtis	Hackberry
Cheno-am	Includes goosefoot and amaranth families
Descurainia	Tansy mustard, Flixweed
Monocot/Herbaceous dicot	A member of the Monocotyledonae class of Angiosperms, which include grasses, sedges, lilies, and palms/A non-woody member of the Dicotyledonae class of Angiosperms
Medicago	Burclover, Alfalfa
Poaceae C	Members of the grass family with small caryopses, such as *Agrostis* (bentgrass), *Muhlenbergia* (muhly grass), *Poa* (bluegrass), etc.
Prunus-type	Similar to Cherry
Sambucus	Elderberry
Parenchymous tissue	Relatively undifferentiated tissue composed of many similar thin-walled cells–occurs in different plant organs in varying amounts, especially large fleshy organs such as roots and stems
Vitrified tissue	Charred material with a shiny, glassy appearance due to fusion by heat
CHARCOAL/WOOD:	
Artemisia	Sagebrush
Quercus	Oak
Rosaceae	Rose family
Unidentified hardwood	Wood from a broad-leaved flowering tree or shrub
Unidentified hardwood - small	Wood from a broad-leaved flowering tree or shrub, fragments too small for further identification
Unidentified hardwood - vitrified	Wood from a broad-leaved flowering tree or shrub, exhibiting a shiny, glassy appearance due to fusion by heat
Unidentifiable - vitrified	Charcoal exhibiting a shiny, glassy appearance due to fusion by heat

TABLE 3 (Continued)

Scientific Name	Common Name
NON-FLORAL REMAINS:	
Insect puparium	A rigid outer shell made from tough material that includes chitin (a natural polymer found in insect exoskeleton and crab shells) and hardens from a larva's skin to protect the pupa as it develops into an adult insect

TABLE 4
DATABLE CHARCOAL, CHARRED ORGANIC MATERIAL, AND MICROCHARCOAL RECOVERED
IN SAMPLES FROM THE PENROSE DRIVE TRENCH SITE, SALT LAKE CITY, UTAH

Sample No.	Provenience/ Description	Charred organic material/ Charcoal and Weight	Microcharcoal Weight
PD-R12	Bulk sample from soil S5 developed on distal P2 and p1 colluvium; minimum for P1	*Artemisia* charcoal 0.0010 g Unidentified charcoal 0.0033 g Unid. hardwood charcoal 0.0006 g	
PD-R11	Bulk sample from soil S5 developed on distal P2 and p1 colluvium; minimum for P1	*Quercus* charcoal 0.0010 g Unidentified hardwood charcoal 0.0005 g	
PD-R14	Bulk sample from soil S4 developed on P2 colluvium; minimum for P2, maximum for P1	Unidentified hardwood charcoal 0.0006 g	0.0102 g
PD-R9	Bulk sample from soil S4 developed on P2 colluvium; minimum for P2, maximum for P1	Unidentified charcoal 0.0003 g	0.0022 g
PD-R10	Bulk sample from soil S3 developed on P3 colluvium; minimum for P3, maximum for P2	*Prunus*-type seed 0.0005 g Parenchymous tissue 0.0006 g Unid. hardwood charcoal 0.0002 g	0.0029 g
PD-R8	Bulk sample from soil S3 developed on P3 colluvium; minimum for P3, maximum for P2	Unidentified hardwood charcoal 0.0002 g	0.0017 g
PD-R5	Bulk sample from soil S3 developed on P3 colluvium; minimum for P3, maximum for P2	Parenchymous tissue 0.0001 g Unidentified hardwood charcoal 0.0005 g	0.0003 g (do not use)
PD-R15	Bulk sample from soil S2 developed on P4 colluvium; minimum for P4, maximum for P3	Parenchymous tissue 0.0003 g Unidentified hardwood charcoal 0.0012 g	
PD-R6	Bulk sample from soil S2 developed on P4 colluvium; minimum for P4, maximum for P3	Unid. twig charcoal 0.0029 g Unidentified hardwood charcoal 0.0031 g	
PD-R16	Gastropod shells from Provo boulder gravel	Snail shell 0.757 g	
PD-R4	Gastropod shell fragments from soil S1 developed on Provo boulder gravel; possible minimum age for P5	Snail shell 0.076 g	
PD-R2	Charcoal from soil S1 developed on Provo boulder gravel; possible minimum age for P5	cf. Rosaceae charcoal 0.0037 g Unidentified hardwood charcoal 0.0012 g	

TABLE 4 (Continued)

Sample No.	Provenience/ Description	Charred organic material/ Charcoal and Weight	Microcharcoal Weight
PD-R13	Bulk sample from soil S1 possibly developed on distal P5 colluvium; possible minimum age for P5	Parenchymous tissue 0.0111 g Unidentified hardwood charcoal 0.0002 g	
PD-R7	Bulk sample from soil S1 possibly developed on distal P5 colluvium; possible minimum age for P5	Unid. hardwood charcoal 0.0012 g Unid. hardwood twig - vitrified 0.0007 g	
PD-R3	Charcoal from soil S1 developed on P5 colluvium; minimum age for P5	Unidentified hardwood charcoal 0.0035 g	
PD-R1	Charcoal fragment from soil S1 developed on P5 colluvium; minimum age for event P5	Unidentified hardwood charcoal 0.0040 g	

Unid. = Unidentified

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APPENDIX C

SUMMARY OF RADIOCARBON DATING, PENROSE DRIVE SITE

Sample No.	NOSAMS[1] Accession No.	Trench	Station[2] (m)	Depth (m)	Unit Sampled[3]	Material Sampled		Organic Material Dated[4]	Sample Weight (mg)	Pre-Treatment Method	$\delta^{13}C$[5]	Relation to Earthquake[6]	Age[7] (^{14}C yr B.P., ± 1σ)	Age[8] (cal yr B.P., ± 2σ)
						Soil/sediment sampled	Notes							
PD-R1	OS-84833	East	6.28, 2.02	4.1	S1	Charcoal from S1 on scarp-colluvium unit 4	Macro-charcoal sample	8 fragments unidentified hardwood charcoal	4	Acid-base-acid	-26.4	Min - PD5, Max - PD4	9940 ± 65	11,410 ± 260
PD-R2	OS-84840	West	31.15, 2.20	2.3	S2 (top)	Charcoal from top of S2 on boulder gravel unit 3	Macro-charcoal sample	2 fragments *Rosaceae* charcoal	3.7	Acid-base-acid	-24.21	Min - PD5, Max - PD4	9390 ± 45	10,620 ± 120
PD-R3	OS-84846	East	7.14, 2.35	4.0	S1	Charcoal from S1 on scarp-colluvium unit 4	Macro-charcoal sample	18 fragments unidentified hardwood charcoal	3.5	Acid-base-acid	-25.61	Min - PD5	9550 ± 55	10,910 ± 240
PD-R4	*Sample not dated*	West	24.93, 2.75	3.8	S1	Shell from S1 on boulder gravel unit 3	-	Gastropod shell	76	Acid-base-acid	-		-	-
PD-R5	OS-85007	East	5.60, 3.55	2.2	S3	Soil sediment from S3 on scarp-colluvial unit 6b	~22-cm wide, 8-cm high sample area	24 fragments unidentified hardwood charcoal	0.5	Acid-base-acid	-25†	Max - PD2	3560 ± 45	3850 ± 140
PD-R6a	OS-85006	East	6.65, 2.75	3.4	S2	Soil sediment from S2 on scarp-colluvial unit 5	~22-cm wide, 8-cm high sample area	14 fragments unidentified hardwood charcoal	2.9	Acid-base-acid	-25.99	Max PD3/PD3b	9350 ± 50	10,570 ± 140
PD-R6b	OS-84835	East	6.65, 2.75	3.4	S2	Soil sediment from S2 on scarp-colluvial unit 5	~22-cm wide, 8-cm high sample area	6 fragments unidentified twig, vitrified	3.1	Acid-base-acid	-25.85	Max PD3/PD3b	8990 ± 55	10,120 ± 200
PD-R7	*Sample not dated*	East	6.58, 2.23	4.0	S1	Soil sediment from S1 on scarp colluvial unit 4	~16-cm wide, 8-cm high sample area	Many fragments unidentified hardwood charcoal	1.2	-	-	-	-	-
PD-R8	OS-87068	East (west wall)	6.17, 3.52	2.1	S3	Soil sediment from S3 on scarp-colluvial unit 6b (same position as R5)	~22-cm wide, 6-cm high sample area	Microcharcoal	1.7	Acid-base-acid	-28.9	Max - PD2	5480 ± 50	6280 ± 120
PD-R9a	*Sample too small to date*	West	22.94, 5.56	1.5	S4	Soil sediment from S4 on scarp-colluvial unit 7	~18-cm wide, 8-cm high sample area	4 fragments unidentified hardwood charcoal	0.3	Acid-base-acid	-	-	-	-
PD-R9b	OS-87069	West	22.94, 5.56	1.5	S4	Soil sediment from S4 on scarp-colluvial unit 7	~18-cm wide, 8-cm high sample area	Microcharcoal	2.2	Acid-base-acid	-29.14	Max - PD1	3960 ± 45	4420 ± 160
PD-R10a	OS-85121	West	23.6, 4.80	2.0	S3	Soil sediment from S3 on scarp-colluvial unit 6b	~25-cm wide, 8-cm high sample area	1 fragment *Prunus*-type seed, charred	0.5	Acid-base-acid	-25†	Max - PD2	5800 ± 75	6600 ± 180
PD-R10b	OS-87060	West	23.6, 4.80	2.0	S3	Soil sediment from S3 on scarp-colluvial unit 6b	~25-cm wide, 8-cm high sample area	Microcharcoal	2.9	Acid-base-acid	-28.64	Max - PD2	5470 ± 40	6270 ± 80
PD-R11	OS-84850	West	26.85, 4.20	1.7	S1	Soil sediment from base of S1, developed on scarp colluvium	~16-cm wide, 6-cm high sample area	1 fragment *Quercus* charcoal	1.0	Acid-base-acid	-24.84	Min - PD1	490 ± 35	530 ± 40
PD-R12	OS-84847	West	28.85, 3.55	1.6	S1	Soil sediment from base of S1, developed on scarp colluvium	~16-cm wide, 7-cm high sample area	3 fragments *Artemisia* charcoal	1.0	Acid-base-acid	-25.42	Min - PD1	495 ± 30	530 ± 40
PD-R13	OS-85008	West	24.83, 3.03	3.5	S1	Soil sediment from near top of S1 on boulder gravel unit 3	~20-cm wide, 6-cm high sample area	7 fragments unidentified hardwood charcoal	0.2	Acid-base-acid	-25†	Min - PD5, Max - PD4	10,000 ± 75	11,510 ± 320
PD-R14a	OS-85124	West	23.41, 5.46	1.5	S4	Soil sediment from S4 on scarp-colluvial unit 7	12-cm high, 8-cm wide sample area	Many fragments unidentified hardwood charcoal	0.6	Acid-base-acid	-25†	Max - PD1	3790 ± 65	4180 ± 220
PD-R14b	OS-87000	West	23.41, 5.46	1.5	S4	Soil sediment from S4 on scarp-colluvial unit 7	12-cm high, 8-cm wide sample area	Microcharcoal	10.2	Acid-base-acid	-28.89	Max - PD1	3790 ± 40	4170 ± 140
PD-R15	OS-84849	West	25.00, 3.40	3.1	S2	Soil sediment from S2 on scarp-colluvial unit 5	~22-cm wide, 7-cm high sample area	11 fragments unidentified hardwood charcoal	1.2	Acid-base-acid	-25.95	Max PD3/PD3b	9400 ± 50	10,630 ± 140
PD-R16	*Sample not dated*	West	26.0, 3.0 to 29.6, 2.0	3.5–2.8	S1	Shells from S1 and boulder-gravel unit 3; location not shown on log	-	Many gastropod shells	757	-	-	-	-	-

[1] National Ocean Sciences Accelerator Mass Spectrometry Facility, Woods Hole Oceanographic Institution (Woods Hole, Massachusetts).
[2] Station coordinates are horizontal and vertical meter marks along arbitrary reference grid for trench site (see plate 1).
[3] See appendix A for descriptions of stratigraphic units.
[4] Separation and identification by Paleo Research Institute (Golden, Colorado).
[5] Measured delta ^{13}C values. † Assumed value.
[6] Min (max) indicates minimum (maximum) limiting time constraint for a surface-faulting earthquake (e.g., PD1).
[7] Laboratory-reported radiocarbon age with one standard deviation uncertainty. B.P. is before present (AD 1950).
[8] Mean calendar-calibrated age and two-sigma uncertainty, rounded to nearest decade, determined using OxCal calibration software (v. 4.1; Bronk Ramsey, 2009) and the IntCal09 atmospheric data set (Reimer and others, 2009).

APPENDIX D

SUMMARY OF LUMINESCENCE DATING, PENROSE DRIVE SITE

Sample No.[1]	Trench	Station[2] (m)	Depth (m)	Unit Sampled[3]	Material Sampled	Stratigraphic Position	Water Content[4] (%)	K[5] (ppm)	U[5] (ppm)	Th[5] (ppm)	Cosmic Dose Additions[6] (Gy/ka)	Total Dose Rate OSL[7] (IRSL)[8] (Gy/ka)	Equivalent Dose OSL[7] (IRSL)[8] (Gy)	n[9]	Relation to Earthquake[10]	Laboratory Age OSL[7] (IRSL)[8] ± 1σ (yr before 2010)
PD-L1	West	9.15, 9.40	1.0	1	Fine to medium sand laminae	Upper part of pre-Bonneville alluvial fan	1 (35)	1.42 ± 0.03	2.12 ± 0.08	4.60 ± 0.13	0.25 ± 0.02	2.37 ± 0.04 (3.36 ± 0.05)f	>180 (452 ± 9.04)	16 (20)	-	>76,990 ± 3920 (134,730 ± 6850)
PD-L2	West	10.11, 9.33	0.9	1	Fine sand laminae	Same stratigraphic position as L1	11 (38)	1.36 ± 0.03	2.18 ± 0.08	5.14 ± 0.13	0.25 ± 0.02	2.35 ± 0.04	163 ± 9.13	23 (24)	-	69,310 ± 4040
PD-L3	West	11.84, 9.35	0.6	1	Medium-fine sand lense	Similar stratigraphic position as L1 & L2	10 (31)	1.39 ± 0.03	2.10 ± 0.08	4.89 ± 0.13	0.25 ± 0.02	2.39 ± 0.04	154 ± 9.24	25 (25)	-	64,370 ± 3980
PD-L4	West	18.93, 7.66	0.5	1	Sandy gravel horizon	Slightly lower stratigraphic position than L1-L3	8 (37)	1.33 ± 0.03	1.80 ± 0.08	4.25 ± 0.12	0.26 ± 0.02	2.21 ± 0.04 (3.08 ± 0.05)f	130 ± 2.99 (680 ± 9.72)	24 (25)	-	58,790 ± 1700 (220,780 ± 9880)
PD-L5	West	28.24, 1.77	3.6	2	Bonneville silty sand	Immediately below boulder gravel (Provo stage)	12 (31)	1.61 ± 0.03	1.54 ± 0.07	5.22 ± 0.13	0.21 ± 0.01	2.48 ± 0.04	42.1 ± 1.56	25 (25)	Max - PD6	16,990 ± 680
PD-L6	West	30.96, 1.59	3.0	2	Bonneville silty sand	Immediately below boulder gravel (Provo stage)	10 (37)	1.60 ± 0.03	1.44 ± 0.07	4.95 ± 0.13	0.19 ± 0.01	2.38 ± 0.04 (3.24 ± 0.05)f	42.3 ± 2.98 (50.2 ± 0.60)	32 (33)	Max - PD6	17,770 ± 340 (15,490 ± 610)
PD-L7	East	7.10, 2.75	3.5	5	Scarp colluvium	Upper part of unit 5 colluvial wedge	14 (31)	1.22 ± 0.03	1.72 ± 0.07	3.72 ± 0.11	0.18 ± 0.01	2.00 ± 0.03 (2.83 ± 0.05)f	21.9 ± 1.14 (63.2 ± 1.92)	22 (25)	Max - PD3b/PD3, Min - PD4	10,950 ± 600 (22,340 ± 1560)
PD-L8	East	7.03, 3.52	2.7	6a	Scarp colluvium	Upper part of 6a colluvial wedge	9 (35)	1.30 ± 0.03	2.16 ± 0.08	5.41 ± 0.13	0.20 ± 0.01	2.27 ± 0.04	16.7 ± 0.97	18 (20)	Max - PD3a, Min - PD3b/PD3	7360 ± 440
PD-L9	East	5.88, 3.44	2.4	6b	Scarp colluvium	Upper-middle part of 6b colluvial wedge	10 (37)	1.40 ± 0.08	1.45 ± 0.11	5.00 ± 0.21	0.20 ± 0.01	2.21 ± 0.06	18.5 ± 0.91 (23.9 ± 0.51)	19 (20)	Max - PD2, Min - PD3a/PD3	8390 ± 640 (8140 ± 570)

[1] Analyses by U.S. Geological Survey Luminescence Dating Laboratory (Denver, Colorado).
[2] Station coordinates are horizontal and vertical meter marks along arbitrary reference grid for trench (see plate 1).
[3] See appendix A for descriptions of stratigraphic units.
[4] Field moisture; complete sample saturation percent in parentheses.
[5] Analyses obtained using laboratory gamma spectrometry (high-resolution Ge detector) and readings are delayed after 21 days of being sealed in the planchet (used for dose rates).
[6] Cosmic doses and attenuation with depth were calculated using the methods of Prescott and Hutton (1994); Gy – gray.
[7] Dose rate and optically stimulated luminescence (OSL) age for fine-grained (90–125 microns) quartz sand; linear + exponential fit used on equivalent dose, single aliquot regeneration; ages rounded to nearest decade, errors to one sigma.
[8] Dose rate and infrared stimulated luminescence (IRSL) age for fine grains (4–11 microns) of polymineral silt; exponential fit used for equivalent dose, multiple aliquot additive dose; ages rounded to nearest decade, errors to one sigma; fade tests indicate no correction.
[9] Number of replicated equivalent dose (De) estimates used to calculate the mean; total number of measurements made, including failed runs with unusable data, in parentheses.
[10] Min (max) indicates minimum (maximum) limiting time constraint for a surface-faulting earthquake (e.g., PD6).

APPENDIX E

OXCAL MODELS FOR THE SALT LAKE CITY SEGMENT

OxCal models for the Penrose Drive, Little Cottonwood Canyon, and South Fork Dry Creek (SFDC) sites were created using OxCal calibration and analysis software (version 4.1; Bronk Ramsey, 1995, 2001; using the IntCal09 calibration curve of Reimer and others, 2009). The models include *C_Date* for luminescence ages, *R_Date* for radiocarbon ages, and *Boundary* for undated events (paleoearthquakes). For the SFDC model, *Delta_R* accounts for the bulk-soil residence time following DuRoss and others (2011). These components are arranged into ordered sequences based on the relative stratigraphic positions of the samples. The sequences may contain *phases*, or groups where the relative stratigraphic ordering information for the individual radiocarbon ages is unknown. The models are presented here in reverse stratigraphic order, following the order in which the ages and events are evaluated in OxCal.

OxCal Input

Penrose Drive Version 4b – 7 Events (preferred)

```
Plot()
 {
  Sequence("SLCS_Penrose_v4b_post_Bonneville.oxcal")
  {
   Boundary("start");
   Phase("Unit 2 - Bonn. silt")
   {
    C_Date("L6, 17.8+/-0.7 ka",-15760,340);
    C_Date("L5, 17.0+/-1.4 ka",-14980,680);
   };
   Boundary("P6");
   C_Date("Godsey et al., 2005", -13619,1360);
   Boundary("P5");
   Phase("Soil S1")
   {
    R_Date("R13, 10000+/-75",10000,75);
    R_Date("R1, 9940+/-65",9940,65);
    //R_Date("R2, 9390+/-45",9390,45);
    R_Date("R3, 9550+/-55",9550,55);
   };
   Boundary("P4");
   C_Date("L7, 11.0+/-1.2 ka",-8940,600);
   Phase("Soil S2")
   {
    R_Date("R15, 9400+/-50",9400 ,50 );
    R_Date("R6a, 9350+/-50",9350 ,50 );
```

```
   R_Date("R6b, 8990+/-55",8990 ,55 );
  };
  Boundary("P3b");
  C_Date("L8, 7.4+/-0.9 ka",-5350,440);
  Boundary("P3a");
  C_Combine("L9")
  {
   C_Date("R9-OSL, 8.4 ka", -6380, 640);
   C_Date("R9-IRSL, 8.1 ka", -6130, 570);
  };
  Phase("Soil S3")
  {
   R_Date("R8, 5480+/-50", 5480, 50);
   R_Date("R10a, 5800+/-75", 5800, 75);
   R_Date("R10b, 5470+/-40", 5470, 40);
  };
  Boundary("P2");
  Zero_Boundary("Unit 7");
  Phase("Soil S4")
  {
   R_Date("R9b, 3960+/-45", 3960,45);
   R_Date("R14a, 3790+/-65", 3790, 65);
   R_Date("R14b, 3790+/-40", 3790, 40);
  };
  Boundary("P1");
  Zero_Boundary("Unit 8");
  Phase("Soil S5")
  {
   R_Date("R11, 490+/-35", 490,35);
   R_Date("R12, 495+/-30", 495,30);
  };
  Boundary("Begin Historical Record",1847 AD);
 };
};
```

Penrose Drive Version 4c – 6 Events

```
Plot()
 {
  Sequence("SLCS_Penrose_v4c_post_Bonneville.oxcal")
  {
   Boundary("start");
   Phase("Unit 2 - Bonn. silt")
   {
    C_Date("L6, 17.8+/-0.7 ka",-15760,340);
    C_Date("L5, 17.0+/-1.4 ka",-14980,680);
```

```
};
Boundary("P6");
C_Date("Godsey et al., 2005", -13619,1360);
Boundary("P5");
Phase("Soil S1")
{
 R_Date("R13, 10000+/-75",10000,75);
 R_Date("R1, 9940+/-65",9940,65);
 //R_Date("R2, 9390+/-45",9390,45);
 R_Date("R3, 9550+/-55",9550,55);
};
Boundary("P4");
C_Date("L7, 11.0+/-1.2 ka",-8940,600);
Phase("Soil S2")
{
 R_Date("R15, 9400+/-50",9400 ,50 );
 R_Date("R6a, 9350+/-50",9350 ,50 );
 R_Date("R6b, 8990+/-55",8990 ,55 );
};
Boundary("P3b");
C_Date("L8, 7.4+/-0.9 ka",-5350,440);
C_Combine("L9")
{
 C_Date("R9-OSL, 8.4 ka", -6380, 640);
 C_Date("R9-IRSL, 8.1 ka", -6130, 570);
};
Phase("Soil S3")
{
 R_Date("R8, 5480+/-50", 5480, 50);
 R_Date("R10a, 5800+/-75", 5800, 75);
 R_Date("R10b, 5470+/-40", 5470, 40);
};
Boundary("P2");
Zero_Boundary("Unit 7");
Phase("Soil S4")
{
 R_Date("R9b, 3960+/-45", 3960,45);
 R_Date("R14a, 3790+/-65", 3790, 65);
 R_Date("R14b, 3790+/-40", 3790, 40);
};
Boundary("P1");
Zero_Boundary("Unit 8");
Phase("Soil S5")
{
 R_Date("R11, 490+/-35", 490,35);
 R_Date("R12, 495+/-30", 495,30);
```

```
   };
   Boundary("Begin Historical Record",1847 AD);
  };
 };
```

Little Cottonwood Canyon

```
Plot()
 {
  Sequence("SLCS LCC ver . 4; ET predates Flood")
  {
   Boundary("Sequence start ");
   R_Date("Bonneville reaches trench elev.", 16800, 250);
   R_Date("Bonneville highstand", 15000, 250);
   Boundary("ET");
   R_Date("Bonneville Flood", 14500, 250);
   (Boundary("ET"); –ET postdates Bonneville Flood in version 4b)
   R_Date("C13; 5cACb5", 12150, 70);
   R_Date("C26; 5cAC", 12160, 60);
   Phase("Soil on upper 5c")
   {
    R_Date("C28; 5cAkb5", 11980, 50);
    R_Date("C10; 5cAkb5", 10320, 60);
    R_Date("C12; 5cAb5", 10260, 330);
    R_Date("C3; 5cAb5", 9960, 50);
    R_Date("C11; 5cAb5", 9540, 60);
    R_Date("C1; 6btb4", 8680, 60);
   };
   Boundary("EU");
    R_Date("C5; 7c lower", 8350, 50);
   R_Date("C6; 7c upper", 8070, 50);
   //ZB: Min age (C25) closer constraint on EV time
   Zero_Boundary("V");
   Boundary("EV");
   R_Date("C25; W7fAb4", 6640, 180);
   //ZB: Min age (C20) closer constraint on EW time
   Zero_Boundary("W");
   Boundary("EW");
   R_Date("C20; E8Ab2", 4560, 40);
   //ZB: Min ages (C19,C21) closer constraint on EX time
   Zero_Boundary("X");
   Boundary("EX");
   R_Date("C21; E9bABb1", 3820, 120);
   R_Date("C19; E9bAb1", 3000, 40);
   R_Date("C24; W9Ab2", 2280, 40);
   Boundary("EY");
```

```
  //ZB: Max age (C24) closer constraint on EY time
  Zero_Boundary("Y");
  R_Date("C16; E10a", 1890, 80);
  Phase("EY colluv./EZ fissure")
  {
   R_Date("C26a; younger FF", 1570, 70);
   R_Date("C17; E10b", 1440, 70);
   R_Date("C23; W10Ab1", 1130, 70);
  };
  Boundary("EZ");
  R_Date("C18; E11", 1540, 40);
  C_Date("Historic constraint AD 1850", 1850, 5);
  Boundary("Sequence end");
 };
};
```

South Fork Dry Creek/Dry Gulch

```
Plot()
 {
  Sequence("SLCS SFDC ver. 6f ")
  {
   Boundary("Sequence start ");
   Phase("Soil on fan deposits; DC-1, DC-2")
   {
    Delta_R("MRT-200yr1", 200, 200);
    R_Date("DC-1-R1", 5230, 160);
    R_Date("DC-1-R2", 4910, 200);
    R_Date("DC-2-R1", 4710, 180);
    Delta_R("MRT-0yr", 0, 100);
    R_Date("DC-1-R6", 4520, 120);
   };
   Boundary("EW");
   //ZB: Max ages closer constraint on EW time
   Zero_Boundary("W");
   Delta_R("MRT-150yr1", 150, 75);
   R_Date("DC2-2-R1", 3810, 180);
   Boundary("EX");
   Phase("post EX deposits; DC2-4")
   {
    Delta_R("MRT-300yr1", 300, 300);
    R_Date("DC2-4-R3", 3910, 140);
    R_Date("DC2-4-R4", 3760, 160);
   };
   Phase("Soil on fan - pre EY; DC2-5, DG")
   {
```

```
  Delta_R("MRT-200yr2", 200, 200);
  R_Date("DC2-5-R3", 3090, 120);
  Delta_R("MRT-100yr2", 100, 50);
  R_Date("APST-BS2", 2370, 140);
  R_Date("APST-BS3", 2410, 120);
 };
 Boundary("EY");
 //ages removed - stratigraphically out of place
 #Delta_R("MRT-200yr", 200, 200);
 #R_Date("DC2-5-R1", 2570, 140);
 #R_Date("DC2-1-R1", 3000, 160);
 //ZB: Max ages closer constraint on EY time
 Zero_Boundary("Y");
 Phase("soil on fan/colluvium pre EZ");
 {
  Delta_R("MRT-200yr3", 200, 200);
  R_Date("DC-1-R4", 2310, 140);
  R_Date("DC-1-R3", 1830, 160);
  Delta_R("MRT-150yr2", 150, 150);
  R_Date("DC2-1-R2", 1850, 120);
  Delta_R("MRT-200yr4", 200, 200);
  R_Date("DC-2-R3", 1640, 100);
  Delta_R("MRT-100yr3", 100, 50);
  R_Date("APST-BS1", 1770, 120);
  R_Date("DC2-3-R2", 1420, 160);
  //These ages removed as per discussion in Black et al.
  #Delta_R("MRT-0yr", 0, 0);
  #R_Date("DC-2-R2", 1170, 120);
  #R_Date("DC-1-R5", 930, 120);
 };
 Boundary("EZ");
 Phase("Post EZ deposits");
 {
  Delta_R("MRT-300yr2", 300, 300);
  R_Date("DC2-4-R2", 1620, 100);
  R_Date("DC2-2-R2", 1570, 120);
  Delta_R("MRT-100yr5", 100, 50);
  R_Date("DC2-3-R1", 1240, 140);
  Delta_R("MRT-200yr5", 200, 200);
  R_Date("DC2-3-R3", 1160, 160);
 };
 C_Date("Historic constraint AD 1850", 1850, 5);
 Boundary("Sequence end");
};
};
```

Penrose Drive Version 4b	**Unmodelled (BP)**		**Modelled (BP)**		**Agreement**
(7 event model)	Mean	1s	Mean	1s	
Boundary start			18350	1090	
Phase Unit 2 - Bonn. silt					
C_Date L6, 17.8±0.7 ka	17710	340	17590	320	98.9
C_Date L5, 17.0±1.4 ka	16930	680	17240	530	103.4
Boundary P6			**16480**	**960**	
C_Date Godsey et al., 2005	15570	1360	14970	1100	104.3
Boundary P5			**12080**	**810**	
Phase Soil S1					
R_Date R13, 10000±75	11510	160	11460	140	103.7
R_Date R1, 9940±65	11410	130	11390	120	105.4
R_Date R3, 9550±55	10910	120	11000	100	99.1
Boundary P4			**10870**	**120**	
C_Date L7, 11.0±1.2 ka	10890	600	10750	100	135.5
Phase Soil S2					
R_Date R15, 9400±50	10630	70	10610	60	100.4
R_Date R6a, 9350±50	10570	70	10560	70	101.6
R_Date R6b, 8990±55	10120	100	10150	90	111.6
Boundary P3b			**9700**	**560**	
C_Date L8, 7.4±0.9 ka	7300	440	7820	360	72.4
Boundary P3a			**7520**	**380**	
C_Combine L9	8190	430	7330	350	32.3
Phase Soil S3					
R_Date R8, 5480±50	6280	60	6280	50	100.5
R_Date R10a, 5800±75	6600	90	6600	90	100.2
R_Date R10b, 5470±40	6270	40	6270	40	99.8
Boundary P2			**5890**	**350**	
Zero_Boundary Unit 7			4840	410	
Phase Soil S4					
R_Date R9b, 3960±45	4420	80	4380	80	86.4
R_Date R14a, 3790±65	4180	110	4210	100	104
R_Date R14b, 3790±40	4170	70	4190	70	98.5
Boundary P1			**4000**	**260**	
Zero_Boundary Unit 8			1770	870	
Phase Soil S5					
R_Date R11, 490±35	530	20	520	20	99.7
R_Date R12, 495±30	530	20	530	20	99.5
Boundary Historical Record, 1847	100	0	100	0	100

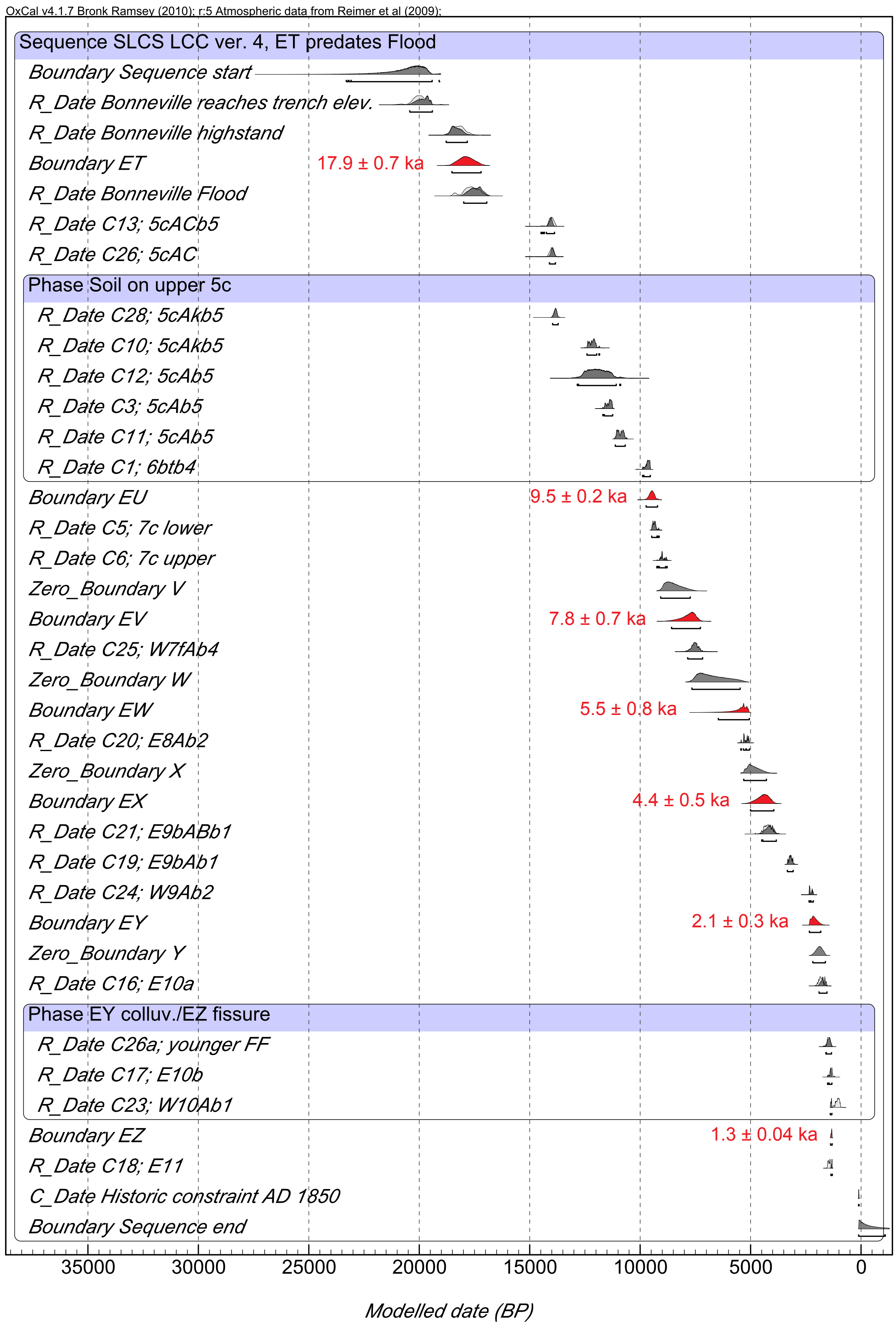
Penrose Drive Version 4c	**Unmodelled (BP)**		**Modelled (BP)**		**Agreement**
(6 event model)	Mean	1s	Mean	1s	
Boundary start			18420	1180	
Phase Unit 2 - Bonn. silt					
C_Date L6, 17.8±0.7 ka	17710	340	17600	330	99.1
C_Date L5, 17.0±1.4 ka	16930	680	17240	530	103.2
Boundary P6			**16460**	**970**	
C_Date Godsey et al., 2005	15570	1360	14960	1100	104.1
Boundary P5			**12070**	**810**	
Phase Soil S1					
R_Date R13, 10000±75	11510	160	11460	140	103.6
R_Date R1, 9940±65	11410	130	11390	120	105.7
R_Date R3, 9550±55	10910	120	11000	100	98.7
Boundary P4			**10880**	**120**	
C_Date L7, 11.0±1.2 ka	10890	600	10750	110	135.7
Phase Soil S2					
R_Date R15, 9400±50	10630	70	10610	60	100.7
R_Date R6a, 9350±50	10570	70	10560	70	101.5
R_Date R6b, 8990±55	10120	100	10140	90	107.4
Boundary P3			**9370**	**770**	
C_Date L8, 7.4±0.9 ka	7300	440	7860	340	67.7
C_Combine L9	8190	430	7600	330	61.1
Phase Soil S3					
R_Date R8, 5480±50	6280	60	6280	50	100.2
R_Date R10a, 5800±75	6600	90	6600	90	100
R_Date R10b, 5470±40	6270	40	6270	40	99.7
Boundary P2			**5770**	**410**	
Zero_Boundary Unit 7			4820	390	
Phase Soil S4					
R_Date R9b, 3960±45	4420	80	4380	80	85.7
R_Date R14a, 3790±65	4180	110	4210	90	104.1
R_Date R14b, 3790±40	4170	70	4190	70	98.5
Boundary P1			**4010**	**250**	
Zero_Boundary Unit 8			1770	870	
Phase Soil S5					
R_Date R11, 490±35	530	20	520	20	99.8
R_Date R12, 495±30	530	20	530	20	99.6
Boundary Historical Record, 1847	100	0	100	0	100

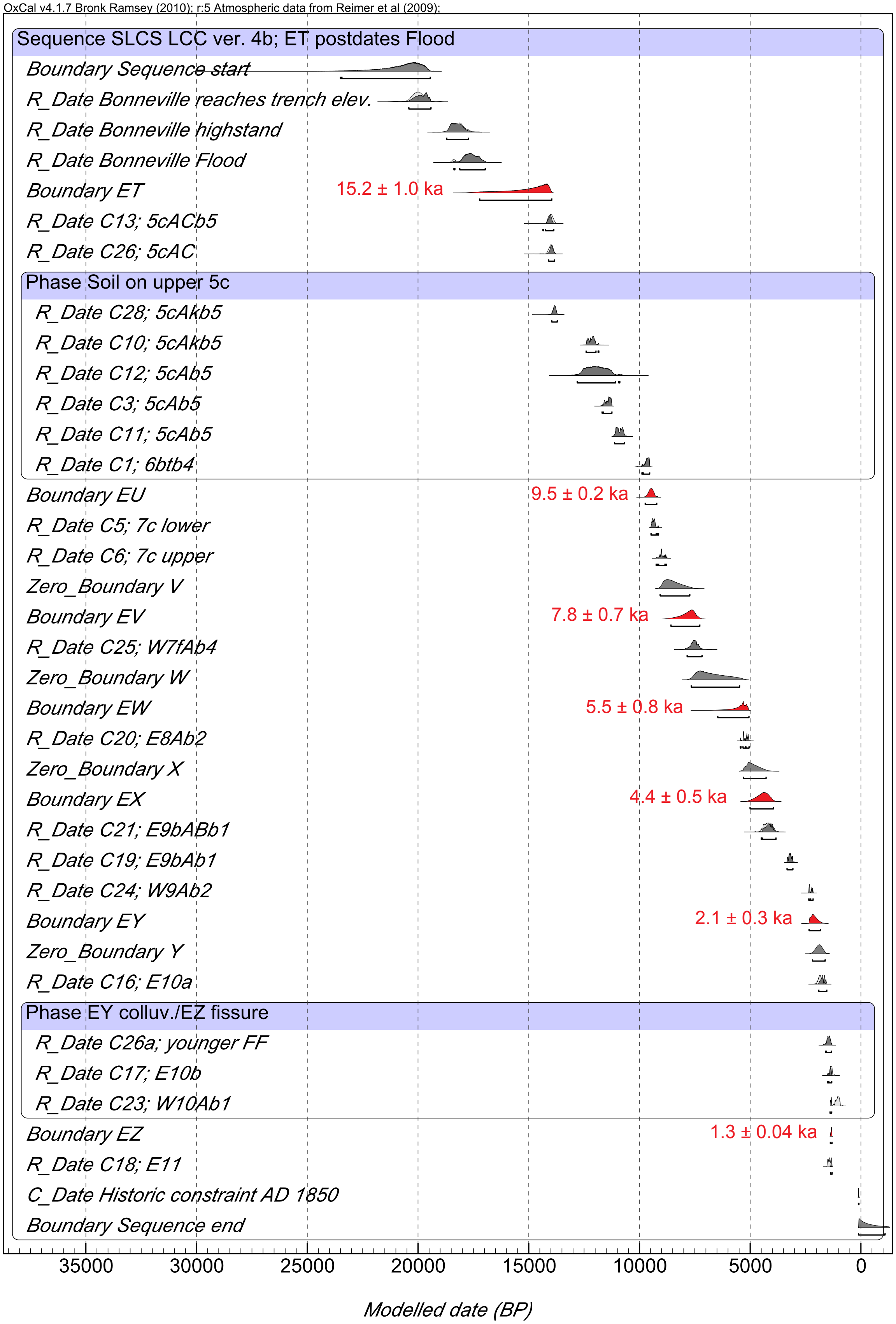
Little Cottonwood Canyon	**Unmodelled (BP)**		**Modelled (BP)**		**Agreement**
Version 4	Mean	1s	Mean	1s	
Boundary Sequence start			20720	1110	
R_Date Bonneville reaches trench elev.	19980	310	19840	290	99.2
R_Date Bonneville highstand	18210	280	18320	240	103.5
Boundary ET			**17880**	**340**	
R_Date Regression to Provo shoreline	17650	350	17460	280	100.1
R_Date C13; 5cACb5	14010	130	14080	140	93.2
R_Date C26; 5cAC	14010	110	13970	70	108
Version 4b					
Boundary Sequence start			*20880*	*1200*	
R_Date Bonneville reaches trench elev.	*19980*	*310*	*19870*	*290*	*100.5*
R_Date Bonneville highstand	*18210*	*280*	*18250*	*250*	*103.4*
R_Date Regression to Provo shoreline	*17650*	*350*	*17600*	*310*	*105.2*
Boundary ET			***15220***	***1000***	
R_Date C13; 5cACb5	*14010*	*130*	*14070*	*120*	*97.3*
R_Date C26; 5cAC	*14010*	*110*	*13970*	*70*	*107.6*
Version 4 (and 4b) continued					
Phase Soil on upper 5c					
R_Date C28; 5cAkb5	13840	70	13830	60	104.5
R_Date C10; 5cAkb5	12170	140	12170	140	100
R_Date C12; 5cAb5	11930	460	11940	460	100
R_Date C3; 5cAb5	11420	120	11420	120	100
R_Date C11; 5cAb5	10900	130	10900	130	99.9
R_Date C1; 6btb4	9660	90	9680	100	94.4
Boundary EU			**9470**	**120**	
R_Date C5; 7c lower	9360	70	9340	80	94.3
R_Date C6; 7c upper	8960	100	9010	100	101.4
Zero_Boundary V			8490	360	
Boundary EV			**7830**	**330**	
R_Date C25; W7fAb4	7530	160	7520	160	100.4
Zero_Boundary W			6720	610	
Boundary EW			**5530**	**400**	
R_Date C20; E8Ab2	5200	100	5210	100	99.4
Zero_Boundary X			4860	270	
Boundary EX			**4440**	**270**	
R_Date C21; E9bABb1	4220	170	4140	160	95.8
R_Date C19; E9bAb1	3200	70	3200	70	99.7
R_Date C24; W9Ab2	2270	60	2280	60	105.9
Boundary EY			**2110**	**140**	

Zero_Boundary Y			1890	150	
R_Date C16; E10a	1830	100	1720	100	74.1
Phase EY colluv./EZ fissure					
R_Date C26a; younger FF	1470	70	1460	60	105.8
R_Date C17; E10b	1360	70	1390	50	92.1
R_Date C23; W10Ab1	1060	80	1350	20	
Boundary EZ			**1340**	**20**	
R_Date C18; E11	1440	50	1330	20	15.8
C_Date Historic constraint AD 1850	100	10	100	10	92.6
Boundary Sequence end			-310	350	

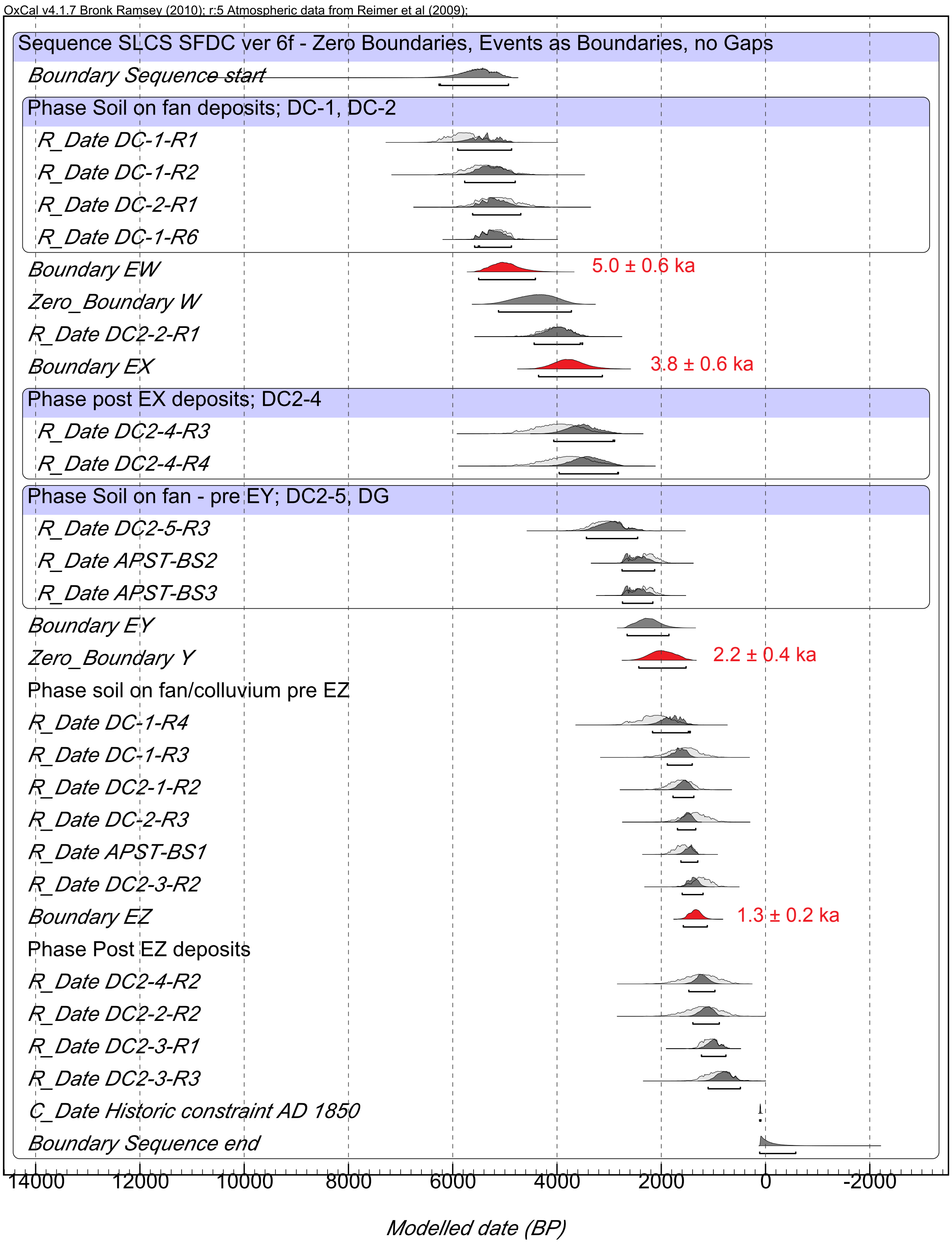
South Fork Dry Creek/Dry Gulch	**Unmodelled (BP)**		**Modelled (BP)**		**Agreement**
Version 6f	Mean	1s	Mean	1s	
Boundary Sequence start			5560	360	
Phase Soil on fan deposits; DC-1, DC-2					
Delta_R MRT-200yr1	200	200	333.386	162.56	94.7
R_Date DC-1-R1	5780	300	5410	270	65.6
R_Date DC-1-R2	5370	350	5270	250	109.4
R_Date DC-2-R1	5140	340	5190	240	115.3
Delta_R MRT-0yr	-1.82E-07	100	-8.88798	92.0309	104
R_Date DC-1-R6	5170	210	5220	190	102
Boundary EW			**4980**	**280**	
Zero_Boundary W			4410	360	
Delta_R MRT-150yr1	150	75	151.566	73.6144	100.9
R_Date DC2-2-R1	4020	270	3990	230	106.2
Boundary EX			**3760**	**300**	
Phase post EX deposits; DC2-4					
Delta_R MRT-300yr1	300	300	580.637	222.109	86
R_Date DC2-4-R3	3970	430	3510	290	81.1
R_Date DC2-4-R4	3780	440	3400	290	91.6
Phase Soil on fan - pre EY; DC2-5, DG					
Delta_R MRT-200yr2	200	200	250.972	178.804	104.5
R_Date DC2-5-R3	3050	280	2960	240	102.8
Delta_R MRT-100yr2	100	50	75.4261	49.7092	93.9
R_Date APST-BS2	2310	200	2470	180	86
R_Date APST-BS3	2360	190	2480	170	92.6
Boundary EY			**2250**	**210**	
Zero_Boundary Y			1980	230	
Phase soil on fan/colluvium pre EZ					
Delta_R MRT-200yr3	200	200	280.756	135.383	110.5
R_Date DC-1-R4	2110	300	1800	180	82.3
R_Date DC-1-R3	1580	280	1640	120	123.8
Delta_R MRT-150yr2	150	150	172.553	108.534	113.6
R_Date DC2-1-R2	1640	210	1570	100	121.5
Delta_R MRT-200yr4	200	200	66.1274	110.7	104.4
R_Date DC-2-R3	1360	240	1500	90	111.7
Delta_R MRT-100yr3	100	50	101.061	48.0054	102
R_Date APST-BS1	1590	140	1460	90	95.1
R_Date DC2-3-R2	1230	170	1390	100	82.4
Boundary EZ			**1350**	**110**	
Phase Post EZ deposits					
Delta_R MRT-300yr2	300	300	342.961	136.187	127.6
R_Date DC2-4-R2	1250	320	1220	120	131.6

R_Date DC2-2-R2	1210	320	1120	130	129.5
Delta_R MRT-100yr5	100	50	106.959	48.9048	100.6
R_Date DC2-3-R1	1060	150	990	120	102.1
Delta_R MRT-200yr5	200	200	271.902	169.895	105.1
R_Date DC2-3-R3	920	230	780	160	107
C_Date Historic constraint AD 1850	100	10	100	10	92.5
Boundary Sequence end			-100	230	


OxCal v4.1.7 Bronk Ramsey (2010); r:5 Atmospheric data from Reimer et al (2009);
Sequence SLCS LCC ver. 4, ET predates Flood
Boundary Sequence start
R_Date Bonneville reaches trench elev.
R_Date Bonneville highstand
Boundary ET
17.9 ± 0.7 ka
R_Date Bonneville Flood
R_Date C13; 5cACb5
R_Date C26; 5cAC
Phase Soil on upper 5c
R_Date C28; 5cAkb5
R_Date C10; 5cAkb5
R_Date C12; 5cAb5
R_Date C3; 5cAb5
R_Date C11; 5cAb5
R_Date C1; 6btb4
Boundary EU
9.5 ± 0.2 ka
R_Date C5; 7c lower
R_Date C6; 7c upper
Zero_Boundary V
Boundary EV
7.8 ± 0.7 ka
R_Date C25; W7fAb4
Zero_Boundary W
Boundary EW
5.5 ± 0.8 ka
R_Date C20; E8Ab2
Zero_Boundary X
Boundary EX
4.4 ± 0.5 ka
R_Date C21; E9bABb1
R_Date C19; E9bAb1
R_Date C24; W9Ab2
Boundary EY
2.1 ± 0.3 ka
Zero_Boundary Y
R_Date C16; E10a
Phase EY colluv./EZ fissure
R_Date C26a; younger FF
R_Date C17; E10b
R_Date C23; W10Ab1
Boundary EZ
1.3 ± 0.04 ka
R_Date C18; E11
C_Date Historic constraint AD 1850
Boundary Sequence end
35000
30000
25000
20000
15000
10000
5000
0
Modelled date (BP)



OxCal v4.1.7 Bronk Ramsey (2010); r:5 Atmospheric data from Reimer et al (2009);
Sequence SLCS LCC ver. 4b; ET postdates Flood
Boundary Sequence start
R_Date Bonneville reaches trench elev.
R_Date Bonneville highstand
R_Date Bonneville Flood
Boundary ET
15.2 ± 1.0 ka
R_Date C13; 5cACb5
R_Date C26; 5cAC
Phase Soil on upper 5c
R_Date C28; 5cAkb5
R_Date C10; 5cAkb5
R_Date C12; 5cAb5
R_Date C3; 5cAb5
R_Date C11; 5cAb5
R_Date C1; 6btb4
Boundary EU
9.5 ± 0.2 ka
R_Date C5; 7c lower
R_Date C6; 7c upper
Zero_Boundary V
Boundary EV
7.8 ± 0.7 ka
R_Date C25; W7fAb4
Zero_Boundary W
Boundary EW
5.5 ± 0.8 ka
R_Date C20; E8Ab2
Zero_Boundary X
Boundary EX
4.4 ± 0.5 ka
R_Date C21; E9bABb1
R_Date C19; E9bAb1
R_Date C24; W9Ab2
Boundary EY
2.1 ± 0.3 ka
Zero_Boundary Y
R_Date C16; E10a
Phase EY colluv./EZ fissure
R_Date C26a; younger FF
R_Date C17; E10b
R_Date C23; W10Ab1
Boundary EZ
1.3 ± 0.04 ka
R_Date C18; E11
C_Date Historic constraint AD 1850
Boundary Sequence end
35000
30000
25000
20000
15000
10000
5000
0
Modelled date (BP)



OxCal v4.1.7 Bronk Ramsey (2010); r:5 Atmospheric data from Reimer et al (2009);
Sequence SLCS SFDC ver 6f - Zero Boundaries, Events as Boundaries, no Gaps
Boundary Sequence start
Phase Soil on fan deposits; DC-1, DC-2
R_Date DC-1-R1
R_Date DC-1-R2
R_Date DC-2-R1
R_Date DC-1-R6
Boundary EW
5.0 ± 0.6 ka
Zero_Boundary W
R_Date DC2-2-R1
Boundary EX
3.8 ± 0.6 ka
Phase post EX deposits; DC2-4
R_Date DC2-4-R3
R_Date DC2-4-R4
Phase Soil on fan - pre EY; DC2-5, DG
R_Date DC2-5-R3
R_Date APST-BS2
R_Date APST-BS3
Boundary EY
Zero_Boundary Y
2.2 ± 0.4 ka
Phase soil on fan/colluvium pre EZ
R_Date DC-1-R4
R_Date DC-1-R3
R_Date DC2-1-R2
R_Date DC-2-R3
R_Date APST-BS1
R_Date DC2-3-R2
Boundary EZ
1.3 ± 0.2 ka
Phase Post EZ deposits
R_Date DC2-4-R2
R_Date DC2-2-R2
R_Date DC2-3-R1
R_Date DC2-3-R3
C_Date Historic constraint AD 1850
Boundary Sequence end
14000
12000
10000
8000
6000
4000
2000
0
-2000
Modelled date (BP)

APPENDIX F

SUMMARY OF OXCAL MODELING RESULTS FOR THE SALT LAKE CITY SEGMENT

	Mean[1] (cal yr B.P.)	**2σ**[1] (yr)	**RMS**[2] (yr)	**5th**[3] (cal yr B.P.)	**50th**[3] (cal yr B.P.)	**95th**[3] (cal yr B.P.)	**Mode**[3] (cal yr B.P.)
Penrose Drive (PD)							
PD1	3998	497	260	3530	4070	4245	4095
PD2	5888	705	353	5135	6005	6250	6205
PD3	7515	760	381	6890	7515	8150	7520
PD4	9705	1113	559	8385	9910	10,185	10,155
PD5	10,866	239	119	10,675	10,870	11,055	10,920
PD6	12,081	1587	808	11,400	11,805	13,830	11,620
PD7	16,468	1912	964	14,580	16,680	17,655	17,140
Little Cottonwood Canyon (LCC)							
LCC1 (Z)	1339	39	19	1315	1340	1375	1325
LCC2 (Y)	2105	284	142	1845	2125	2310	2155
LCC3 (X)	4440	545	272	4035	4420	4935	4370
LCC4 (W)	5532	806	404	5130	5410	6410	5315
LCC5 (V)	7826	665	333	7380	7765	8480	7655
LCC6 (U)	9473	243	121	9285	9470	9680	9460
LCC7 (T)[4]	16,547	3048	1525	14,175	17,285	18,325	17,915
South Fork Dry Creek (SFDC)							
SFDC1 (D)	1347	227	113	1165	1345	1530	1330
SFDC2 (C)	2247	414	207	1890	2255	2580	2300
SFDC3 (B)	3756	604	301	3230	3775	4230	3830
SFDC4 (A)	4984	548	275	4490	5010	5400	5050

[1] Mean and two-sigma earthquake times based on exported probability density functions (PDFs) from the OxCal models (appendix E). See DuRoss and others (2011) for discussion of methods.
[2] RMS is square root of the sum of the squared deviations from the mean, using the OxCal timing PDFs.
[3] 5th, 50th, and 95th percent values and modal earthquake times are based on exported OxCal earthquake-timing PDFs.
[4] LCC event T is based on the summed results of two separate OxCal models (see text for discussion).