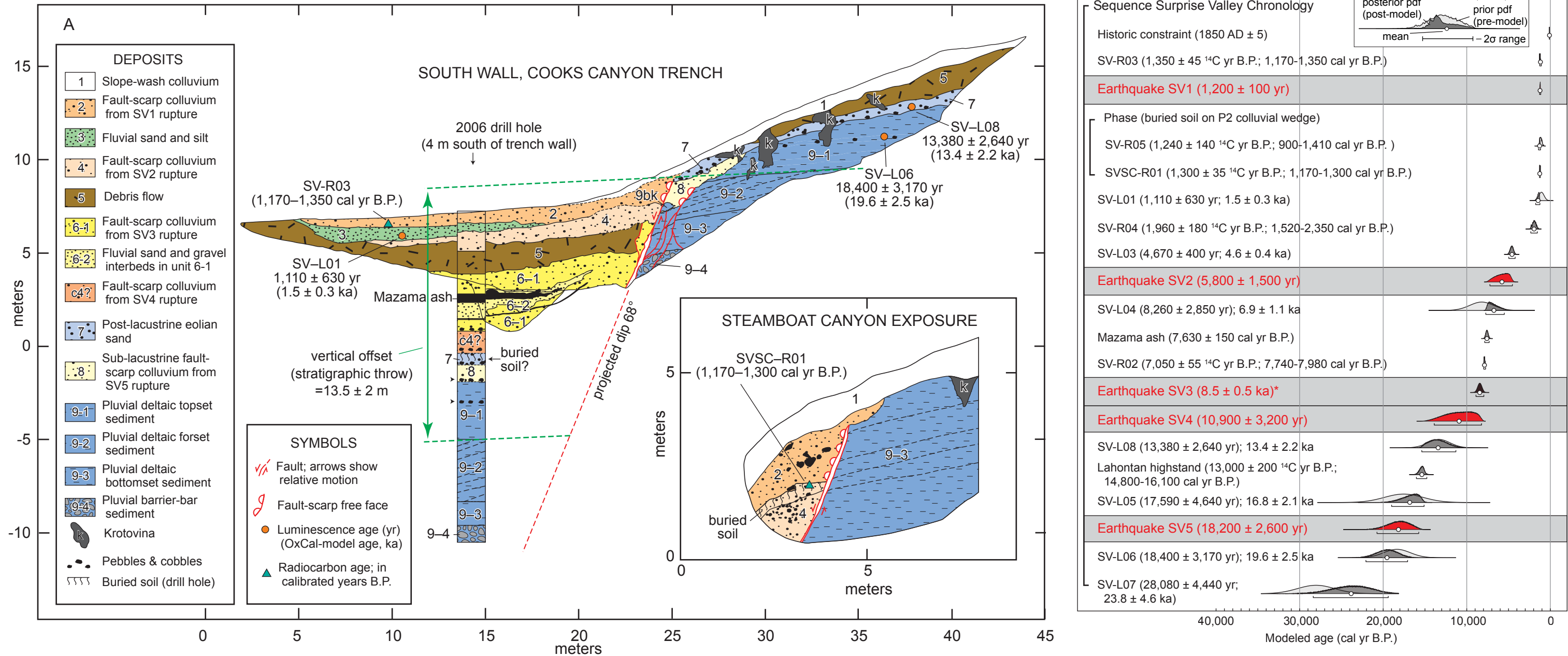Figure S8. Summary figures of paleoseismology of Surprise Valley fault zone. A) Logs from a trench and borehole at the Cooks Canyon site and from a natural exposure at the Steamboat Canyon site (modified from Fig 4 of Personius et al., 2009). B) OxCal model of chronological data (modified from Fig. 6 of Personius et al., 2009).

A

OxCal v4.2.4 Bronk Ramsey (2009); Bronk Ramsey and Lee (2013); r:5 IntCal13 atmospheric curve (Reimer and others, 2013)

B

Sequence Surprise Valley Chronology

modeled earthquake pdf
posterior pdf (post-model)
prior pdf (pre-model)
mean
~ – 2σ range

Historic constraint (1850 AD ± 5)

SV-R03 (1,350 ± 45 ^{14}C B.P.; 1,170-1,350 yr B.P.)

Earthquake SV1 (1,200 ± 100 yr)

Phase (buried soil on P2 colluvial wedge)

SV-R05 (1,240 ± 140 ^{14}C yr B.P.; 900-1,410 cal yr B.P.)

SVSC-R01 (1,300 ± 35 ^{14}C yr B.P.; 1,170-1,300 cal yr B.P.)

SV-L01 (1,110 ± 630 yr; 1.5 ± 0.3 ka)

SV-R04 (1,960 ± 180 ^{14}C yr B.P.; 1,520-2,350 cal yr B.P.)

SV-L03 (4,670 ± 400 yr; 4.6 ± 0.4 ka)

Earthquake SV2 (5,800 ± 1,500 yr)

SV-L04 (8,260 ± 2,850 yr); 6.9 ± 1.1 ka

Mazama ash (7,630 ± 150 cal yr B.P.)

SV-R02 (7,050 ± 55 ^{14}C yr B.P.; 7,740-7,980 cal yr B.P.)

Earthquake SV3 (8.5 ± 0.5 ka)*

Earthquake SV4 (10,900 ± 3,200 yr)

SV-L08 (13,380 ± 2,640 yr); 13.4 ± 2.2 ka

Lahontan highstand (13,000 ± 200 ^{14}C yr B.P.; 14,800-16,100 cal yr B.P.)

SV-L05 (17,590 ± 4,640 yr); 16.8 ± 2.1 ka

Earthquake SV5 (18,200 ± 2,600 yr)

SV-L06 (18,400 ± 3,170 yr); 19.6 ± 2.5 ka

SV-L07 (28,080 ± 4,440 yr; 23.8 ± 4.6 ka)

Modeled age (cal yr B.P.)
40,000   30,000   20,000   10,000   0

SOUTH WALL, COOKS CANYON TRENCH

DEPOSITS

1 Slope-wash colluvium

2 Fault-scarp colluvium from SV1 rupture

3 Fluvial sand and silt

4 Fault-scarp colluvium from SV2 rupture

5 Debris flow

6-1 Fault-scarp colluvium from SV3 rupture

6-2 Fluvial sand and gravel interbeds in unit 6-1

c4? Fault-scarp colluvium from SV4 rupture

7 Post-lacustrine eolian sand

8 Sub-lacustrine fault-scarp colluvium from SV5 rupture

9-1 Pluvial deltaic topset sediment

9-2 Pluvial deltaic forset sediment

9-3 Pluvial deltaic bottomset sediment

9-4 Pluvial barrier-bar sediment

K Krotovina

Pebbles & cobbles

Buried soil (drill hole)

SYMBOLS

Fault; arrows show relative motion

Fault-scarp free face

Luminescence age (yr) (OxCal-model age, ka)

Radiocarbon age; in calibrated years B.P.

2006 drill hole (4 m south of trench wall)

SV-R03 (1,170–1,350 cal yr B.P.)

SV-L01 1,110 ± 630 yr (1.5 ± 0.3 ka)

Mazama ash

vertical offset (stratigraphic throw) =13.5 ± 2 m

projected dip 68°

buried soil?

9bk

SV-L08 13,380 ± 2,640 yr (13.4 ± 2.2 ka)

SV-L06 18,400 ± 3,170 yr (19.6 ± 2.5 ka)

STEAMBOAT CANYON EXPOSURE

SVSC–R01 (1,170–1,300 cal yr B.P.)

buried soil

meters

Summary

The paleoseismology of the Surprise Valley fault is described in detail by Personius et al. (2007, 2009). Data from a trench and borehole at the Cooks Canyon site and from a natural exposure at the Steamboat Canyon site yielded evidence for 5 surface-rupturing earthquakes since ~18 ka (Fig. A; modified from Fig 4 of Personius et al., 2009). The vertical stratigraphic offset of distinctive facies of the faulted deltaic complex at Cooks Canyon is 13.5 ± 2 m (estimated 2σ uncertainties) dated to ~18 ka (Personius et al., 2009; Ibarra et al., 2014); additional slip of ~1.5 m on synthetic fault scarps on the Valley floor (Hedel , 1980, 1984; Bryant, 1990) yields a combined vertical slip of 15 ± 2 m since deposition of the deltaic complex; topographic profiles on scarps across similar-aged deposits indicate slip of similar magnitude at several other locations along the fault zone (Personius et al., 2007). If the paleoseismic record from the Cooks canyon trench is complete, then the five dated surface ruptures averaged ~2.7 m per earthquake. The timing of these earthquakes is constrained by radiocarbon, luminescence, and correlated tephra ages, with the most-recent earthquake well constrained at both the Cooks Canyon and Steamboat Canyon sites at ~1.2 ± 0.1 ka (Fig. B; modified from Figure 6 of Personius et al., 2009).

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