U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

SCIENTIFIC INVESTIGATIONS MAP 2983
Sheet 2 of 2
Version 1.1

Table 2. Radiocarbon data from the Steamboat Canyon and Cooks Canyon sites, Surprise Valley fault zone.

Field[a] number	Lab[b] number	Location x, y (m)	Unit number	Sample weight (mg)	^{13}C[c] ($^0/_{00}$)	Reported[d] age (yr B.P.)	Calibrated age[e] (cal yr B.P.)	Comments
SVSC–R01	OS–51958	3.50, 2.00	3–1	13	-24.97	1,300 ± 35	1,170–1,300	One fragment of *Artemesia* (sagebrush) charcoal.
SV–R03	OS–51985	9.80, 6.50	2–2	3	-24.1	1,350 ± 45	1,170–1,350	Numerous fragments of Rosaceae (rose family) charcoal.
SV–R05	OS–52081	19.70, 6.70	4	7	-28.11	1,240 ± 140	900–1,410	Numerous fragments of unidentified charred organic (plant) tissue.
SV–R04	OS–52086	11.60, 5.70	4	<<1	-25	1,960 ± 180	1,520–2,350	One very small fragment of unidentified hardwood charcoal.
SV–R02	OS–51977	16.90, 2.50	6–5	1	-24.52	7,050 ± 55	7,740–7,980	One fragment of Asteraceae (sunflower family) charcoal.

[a]All samples are from Cooks Canyon trench except SVSC–R01, which is from Steamboat Canyon fault exposure.
[b]Laboratory identifier: OS, National Ocean Sciences Accelerator Mass Spectrometry (AMS) Facility, Woods Hole Oceanographic Institution.
[c]All values measured by AMS laboratory except sample SV–R04, which is assumed.
[d]1 sigma analytical uncertainties reported by AMS laboratory.
[e]2 sigma calibrated age range; calibration from computer program OxCal (version 3.10, Bronk Ramsey, 1995, 2001) and the IntCal 2004 atmospheric data set (Reimer and others, 2004).

Table 3. Chemical analysis and correlation of tephra samples from the Cooks Canyon trench site, Surprise Valley fault zone.

Field[a] number	Lab[b] number	Location x, y (m)	SiO2[c]	Al_2O_3	Fe_2O_3	MgO	MnO	CaO	TiO_2	Na_2O	K_2O	Comments
SV–A01	T529-9	16.4, 2.65	73.73	14.66	2.15	0.44	0.05	1.56	0.44	4.19	2.78	Very fine grained tephra with abundant subangular to subrounded, well vesiculated pumiceous shards. Correlates with Mazama ash (~7,630 ± 150 cal yr B.P., Zdanowicz and others, 1999).
SV–A02	T529-10	17.90, 2.10	71.12	15.35	2.66	0.45	0.06	1.95	0.51	4.54	3.37	Fine grained tephra with abundant subrounded to rounded, FeO and clay coated, well vesiculated pumiceous shards. More heavy minerals and coarser shards than SV–A01. No known correlative, but probably a co-ignimbritic, more basic precursor to Mazama ash of Cascade affinity.

[a]All samples are from Cooks Canyon trench; see logs for locations.
[b]All samples analyzed and correlated at USGS Tephrochronology Laboratory, Menlo Park, California (Elmira Wan, written commun., 2006).
[c]All values measured by electron microprobe and normalized to 100%.

Table 4. Luminescence data from the Cooks Canyon trench site, Surprise Valley fault zone.

Sample number	Location x, y (m)	Unit number	Dating[a] method	Field[b] moisture (pct.)	Equivalent[c] dose (Gy)	Cosmic Dose[d] rate (Gy/ky)	Total Dose[e] rate (Gy/ky)	IRSL or[f] OSL age (yr)	Fading[g] (pct./decade)	Fading-corrected[h] IRSL age (yr)	Preferred age[i] estimate (yr)	Comments
SV–L01	10.55, 5.95	3–1	OSL-L	14.0 ± 1.0	1.40 ± 0.79	0.25 ± 0.02	1.83 ± 0.05	770 ± 880	Na	Na	--	Very small amount of clean quartz resulted in large uncertainties.
			IRSL-E	14.0 ± 1.0	19.5 ± 0.64	0.25 ± 0.02	2.87 ± 0.08	6,800 ± 1,180	4.14	8,270 ± 1,440	--	Probably contaminated with plagioclase.
			IRSL-E	14.0 ± 1.0	2.70 ± 0.84	0.25 ± 0.02	2.87 ± 0.08	940 ± 550	4.14	1,110 ± 630	**1,110 ± 630**	Second pass, after heavy liquid separation and removal of plagioclase grains.
SV–L02	11.70, 5.80	3–2	OSL-L	9.3 ± 1.0	10.2 ± 3.23	0.24 ± 0.02	2.20 ± 0.06	4,640 ± 2,950	--	--	--	Very small amount of clean quartz; underlying radiocarbon age indicates age is too old.
			IRSL-E	9.3 ± 1.0	18.0 ± 0.02	0.24 ± 0.02	3.45 ± 0.10	5,220 ± 680	--	--	--	Very poor test-dose response; underlying radiocarbon age indicates age is too old. Probably contaminated with plagioclase.
SV–L03	12.55, 5.65	4	IRSL-E	11.0 ± 1.0	13.9 ± 0.25	0.23 ± 0.02	3.46 ± 0.12	4,020 ± 430	3.37	4,580 ± 490	**4,670 ± 400**	First pass. Preferred age is weighted mean of fading-corrected IRSL ages from first and second passes.
			IRSL-E	11.0 ± 1.0	15.3 ± 0.26	0.23 ± 0.02	3.46 ± 0.12	4,430 ± 540	3.37	5,150 ± 700	Na	Second pass.
SV–L04	16.30, 4.00	6–2	IRSL-E	10.0 ± 1.0	23.0 ± 0.19	0.18 ± 0.02	3.22 ± 0.09	7,160 ± 2,470	3.37*	8,260 ± 2,850	**8,260 ± 2,850**	Poor test-dose response so uncertainties are large; fading estimated from sample SV–L03.
SV–L08	37.90, 12.90	7	OSL-L	2.8 ± 0.5	22.0 ± 5.07	0.21 ± 0.02	2.00 ± 0.04	11,010 ± 5,080	Na	Na	**13,380 ± 2,640**	Weighted mean of OSL and fading-corrected IRSL ages.
			IRSL-E	2.8 ± 0.5	31.9 ± 0.20	0.21 ± 0.02	2.72 ± 0.05	11,720 ± 2,540	4.09*	14,250 ± 3,090	Na	Fading estimated from sample SV–L05.
SV–L05	25.45, 8.55	8–1	IRSL-E	16.0 ± 1.0	30.7 ± 0.17	0.24 ± 0.02	1.91 ± 0.04	16,070 ± 3,580	4.09	20,460 ± 4,390	--	First pass. Very poor test-dose response; probably contaminated with plagioclase.
			IRSL-E	16.0 ± 1.0	27.4 ± 0.17	0.24 ± 0.02	1.91 ± 0.04	14,350 ± 3,800	4.09	17,590 ± 4,640	**17,590 ± 4,640**	Second pass, after heavy liquid separation and removal of plagioclase grains.
SV–L06	36.30, 11.25	9–2	OSL-L	4.1 ± 0.5	25.1 ± 7.90	0.18 ± 0.02	1.42 ± 0.04	17,700 ± 11,180	Na	Na	**18,400 ± 3,170**	Preferred age is weighted mean of OSL and fading-corrected IRSL ages; small amount of quartz resulted in large OSL uncertainties.
			IRSL-E	4.1 ± 0.5	34.9 ± 3.84	0.18 ± 0.02	2.15 ± 0.07	16,210 ± 3,330	3.52	19,630 ± 4,040	Na	First pass.
			IRSL-E	4.1 ± 0.5	31.3 ± 2.71	0.18 ± 0.02	2.15 ± 0.07	14,630 ± 2,730	3.52	17,640 ± 3,300	Na	Second pass.
SV–L07	25.55, 6.25	9–7	IRSL-E	14.0 ± 1.0	50.4 ± 0.16	0.18 ± 0.02	1.79 ± 0.04	28,080 ± 4,440	--	--	**28,080 ± 4,440**	Poor test-dose response; contaminated with plagioclase?

[a]OSL-L, blue-light optically-stimulated luminescence, single aliquot regeneration, linear fit; IRSL-E, infrared-stimulated luminescence, multiple aliquot additive dose, exponential fit.
[b]Moisture content of sealed field samples measured by weight in the laboratory.
[c]Uncertainties are ± 2 sigma; units in Grays.
[d]Cosmic doses and depth attenuations calculated using the methods of Prescott and Hutton (1994); uncertainties are ± 1 sigma.
[e]Total dose rates are sum of cosmic dose rates and in-situ dose rates measured with Exploranium GR–256 gamma ray spectrometer at field moisture, then recalculated to 5–30 percent moisture based on means of field and full saturation moisture values; uncertainties are ± 1 sigma.
[f]Uncertainties are ± 2 sigma.
[g]Anomalous-fading factor (Huntley and Lamothe, 2001) calculated from laboratory fading tests; values marked with * are estimated from nearby samples; --, not determined, ages likely in error; Na, not applicable to OSL samples.
[h]Corrected ages; anomalous-fading factor in previous column applied to selected IRSL ages (Huntley and Lamothe, 2001); --, not determined, ages likely in error; Na, not applicable to OSL samples.
[i]Preferred ages; mean ages are error weighted (formula of Geyh and Schleicher, 1990); uncertainties are ± 2 sigma; --, not determined, ages likely in error; Na, not applicable.

Table 5. Unit descriptions from the Cooks Canyon trench site, Surprise Valley fault zone.

Unit number	Location x, y (m)	Matrix[a] texture	Percent matrix/gravel	Clast size largest/ave. (cm)	Clast support	Sorting	Bedding[b]	Color and[c] moisture	Dry[d] consistence	Wet[d] consistence	Lower[e] boundary	Genesis	Comments[f]
1	40.05, 15.45	SCL-	80/20	8–10/4	Matrix	Poor	Massive	10YR 3/4 D	sh	ss+, ps	g, w	Slope colluvium	Soil development: 10 cm A over weak Bw over stage I Bk; C horizon noncalcareous.
2–1	21.40, 7.60	SiL	80/20	9/2–4	Matrix	Poor	Massive	10YR 3/4 D	sh-h	ss, ps	g, w	Scarp colluvium	Proximal facies fault-scarp colluvium; extends to ground surface; noncalcareous.
2–2	10.10, 6.65	SL	90/10	2/0.2–0.5	Matrix	Poor	Massive	10YR 3/4 M	sh	ss, ps	a, s	Scarp colluvium	Distal facies fault-scarp colluvium. Soil development: 20–30 cm A over C; blocky soil structure in upper part; noncalcareous.
3–1	9.40, 6.10	SL+	>95/<5	0.5/0.3	Matrix	Well	Massive	10YR 4.5/4 D	sh	ss, ps+	c, w	Fluvial	Soil development: 10–15 cm Ab over weak stage I Bk; slightly calcareous.
3–2	9.50, 5.80	S+	>95/<5	15/0.1–0.2	Matrix	Well	Crude	10YR 3.5/4 M	lo	so, po	a, w	Fluvial	One clast at base 15 cm in diameter; fines upward from coarse to medium sand.
4	11.55, 5.60	SL-	75/25	5-7/1–3	Matrix	Very poor	Massive	10YR 4/3 D	so	ss, po+	g, w	Scarp colluvium	Most clasts are angular volcanics derived from exposure of unit 5 in fault scarp free face; slightly calcareous.
5L	11.50, 4.70	SCL	70/30	10–12/5–8	Matrix	Very poor	Massive	10YR 3/3 M	sh	ss, ps	g, w	Debris flow	Contains abundant angular iron-stained volcanic clasts; slightly calcareous zone in middle of unit. Mapped in hanging wall.
5U	39.55, 14.40	SL-	75/25	12/4	Matrix	Poor	Massive	10YR 5/3.5 D	sh	ss, po	c, w	Debris flow	Contains abundant angular iron-stained volcanic clasts; calcareous. Mapped in footwall.
6–1	22.00, 4.90	S+	65/35	6/2–3	Matrix	Poor	Massive	10YR 5/3 D	sh	so, po	a, w	Channel-fill fluvial	Pebbly and cobbly sand lens fills scarp-parallel channel cut in unit 6–2 near fault zone; calcareous.
6–2	16.45, 3.55	S+	80/20	13/5	Matrix	Very poor	Massive-crude	10YR 5/4 D	so	so, po	a, w	Scarp colluvium	Crudely stratified in places; moderately calcareous.
6–3	19.45, 3.45	S+	80/20	8/3	Matrix	Poor	Massive	10YR 5.5/4 D	lo	so, po	c, w	Channel-fill fluvial	Pebbly and cobbly sand lens fills channel cut in unit 6–2; slightly calcareous.
6–3	17.75, 2.60	S+	85/15	3/0.5	Matrix	Moderate	Crude	10YR 5/4 D	lo	so, po	a, w	Channel-fill fluvial	Sandy silt (reworked loess?) and silty fine sand fills channel cut in unit 6–2; slightly calcareous.
6–4	16.60, 2.70	Si	100/0	NA	Matrix	Well	Fine laminated	10YR 8/1.5 D	lo	so, po	a, s	Volcanic ash	Two deposits mapped: 1) 15- to 20-cm-thick upper ash, chemically correlative with Mazama ash; locally bioturbated; basal 2 cm has coarse, granular pumice-like texture. 2) 1- to 5-cm-thick lower ash; no known chemical correlation but probably a Mazama precursor of Cascade affinity. Lower bed is silty, with increasing ash content in western part of exposure.
6–5	17.20, 2.50	S	85/15	1–2/0.2–0.4	Matrix	Poor	Massive	7.5YR 3/4 M	lo	so, po	a, s	Channel-fill fluvial	Pebbly sand fills channel cut in unit 6–3; siltier and more organic rich upper part is a weak buried A horizon.
6–6	22.45, 3.80	S	>95/<5	1/0.2–0.3	Matrix	Well	Massive	10YR 4/4 D	so	so, po	Ne	Scarp colluvium	Large wedge of sand derived from raveling of friable lacustrine sand (unit 9) exposed in fault scarp free face.
7	37.15, 12.60	SL-	>95/<5	4/1	Matrix	Moderate	Crude-massive	10YR 4/4 M	so	ss, po	c, w	Eolian	Basal contact marked by distinct stone line of mostly rounded pebbles and cobbles (maximum diameter 10–20 cm); angular unconformity with underlying lacustrine beds (unit 9–1). Consists of reworked sediment from upper part of lacustrine sequence (unit 9), deposited after drawdown of pluvial lake; slightly calcareous.
8–1	25.25, 8.60	Si-fn S	>95/<5	1.6 /0.5	Matrix	Moderate	Crude-massive	10YR 4/4 M	sh	so, po	a, s	Scarp colluvium (subaqueous)	Upper facies of fault-scarp colluvium deposited under water after surface rupture. Contains numerous blocks of fine sandy lacustrine sediment (unit 9) in silty fine sand matrix; calcareous.
8–2	25.25, 7.80	Fn-med S	>95/<5	1–1.5/<0.5	Matrix	Moderate	Crude-massive	10YR 4/3 M	lo-so	so, po	a, s	Scarp colluvium (subaqueous)	Lower facies of fault-scarp colluvium deposited under water after surface rupture. Contains numerous blocks of fine sandy lacustrine sediment (unit 9) in fine to medium sand matrix; matrix exhibits some very steeply inclined bedding, deposited against eroded fault scarp free face; weakly to noncalcareous.
9bk	24.75, 7.50	Fn S+	>95/<5	1/0.4	Matrix	Mod.-well	Massive	10YR 3.5/4 D	so	so, po	a, w	Block in colluvium	Large block (or amalgam of smaller blocks) of fine sandy lacustrine sediment (unit 9) in subaqueous fault-scarp colluvium (unit 8–2); calcareous.
9–1	36.20, 12.00	S+	>98/<2	2/0.4	Matrix	Moderate	Crude-massive	10YR 3.5/3 M	lo	so, po	a, s	Lacustrine	Massive lacustrine sand, uppermost unit in lacustrine sequence; fines upward; noncalcareous.
9–2	34.90, 11.10	Med S+	85/15	4/0.8	Matrix	Moderate	Crude	10YR 4/3 M	sh	so, po	c, s	Lacustrine	Crudely bedded lacustrine sand; calcareous.
9–3	33.95, 10.55	S	95/5	1–2/0.5	Matrix	Well	Well	10YR 4/2.5 M	lo	so, po	a, s	Lacustrine	Well stratified deltaic topset beds; well rounded clasts; weakly to noncalcareous.
9–4	33.95, 10.10	Med-cse S	>95/<5	0.5–1/0.3–0.4	Matrix	Well	Well	10YR 3.5/2 M	lo	so, po	a, s	Lacustrine	Well stratified deltaic topset beds, laminated in places; well rounded clasts; weakly to noncalcareous.
9–5	31.60, 9.55	S	>95/<5	6/1	Matrix	Well	Well	10YR 4.5/2 M	lo	so, po	a, s	Lacustrine	Well stratified deltaic topset beds; base marked by stone line of well rounded pebbles; weakly to noncalcareous; angular unconformity with underlying foreset beds (unit 9–6).
9–6	29.05, 8.70	Fn-med S	>95/<5	1/<0.5	Matrix	Well	Well	10YR 4/3 D	lo	so, po	a, s	Lacustrine	Well stratified to laminated deltaic foreset beds, steep (~16°) apparent east dips; weakly to noncalcareous; slight angular unconformity with underlying bottomset beds (unit 9–7).
9–7	26.00, 6.50	Fn S-Si	100/0	NA	NA	Very well	Well	10YR 5/4 M	so	ss, po	a, s	Lacustrine	Laminated deltaic bottomset beds; noncalcareous.
9–8	25.50, 5.60	Fn S-Si to cse S	60–100/40–0	10/2–5	Matrix, clast	Mod.-v. well	Moderate-well	10YR 3/2 M to 10YR 5/4 M	lo-so	so-ss, po	a, s	Lacustrine	Interbedded sandy silt and sand and pebbly sand beds; pebbly at base, sequence fines upward; angular unconformity with underlying barrier bar beds (unit 9-9).
9–9	24.40, 4.70	Cse S	50/50	23/5	Clast, matrix	Moderate	Moderate	10YR 3/2 M	lo	so, po	Ne	Lacustrine	West-dipping (13°) sand and gravel; probably deposited on shore-facing side of barrier bar; carbonate cemented in places.

[a]Matrix texture: SCL, sandy clay loam; SL, sandy loam; S, sand; Si, silt; SiL, silt loam; Qualifiers: fn, fine; med, medium; cse, coarse; +, texture tends toward finer component; -, texture tends toward coarser component.
[b]Bedding: all stratified units are parallel bedded.
[c]Color nomenclature from Munsell Color (1994); Moisture: M, moist; D, dry.
[d]Consistence: Dry: lo, loose; so, soft; sh, slightly hard; h, hard; Wet: so, nonsticky; ss, slightly sticky; po; nonplastic; ps, slightly plastic;+, wet consistence is slightly more plastic.
[e]Lower boundary: Distinctness: a, abrupt (<1 cm); c, clear (1–5 cm); g, gradual (>5 cm); Topography: s, smooth; w, wavy; Ne, not exposed.
[f]Soil horizon nomenclature from Soil Survey Staff (1999) and Birkeland (1999). Chemical fingerprinting of volcanic ash samples (unit 6–4) conducted by USGS Tephrochronology Laboratory, Menlo Park, CA (Elmira Wan, written commun., 2006).

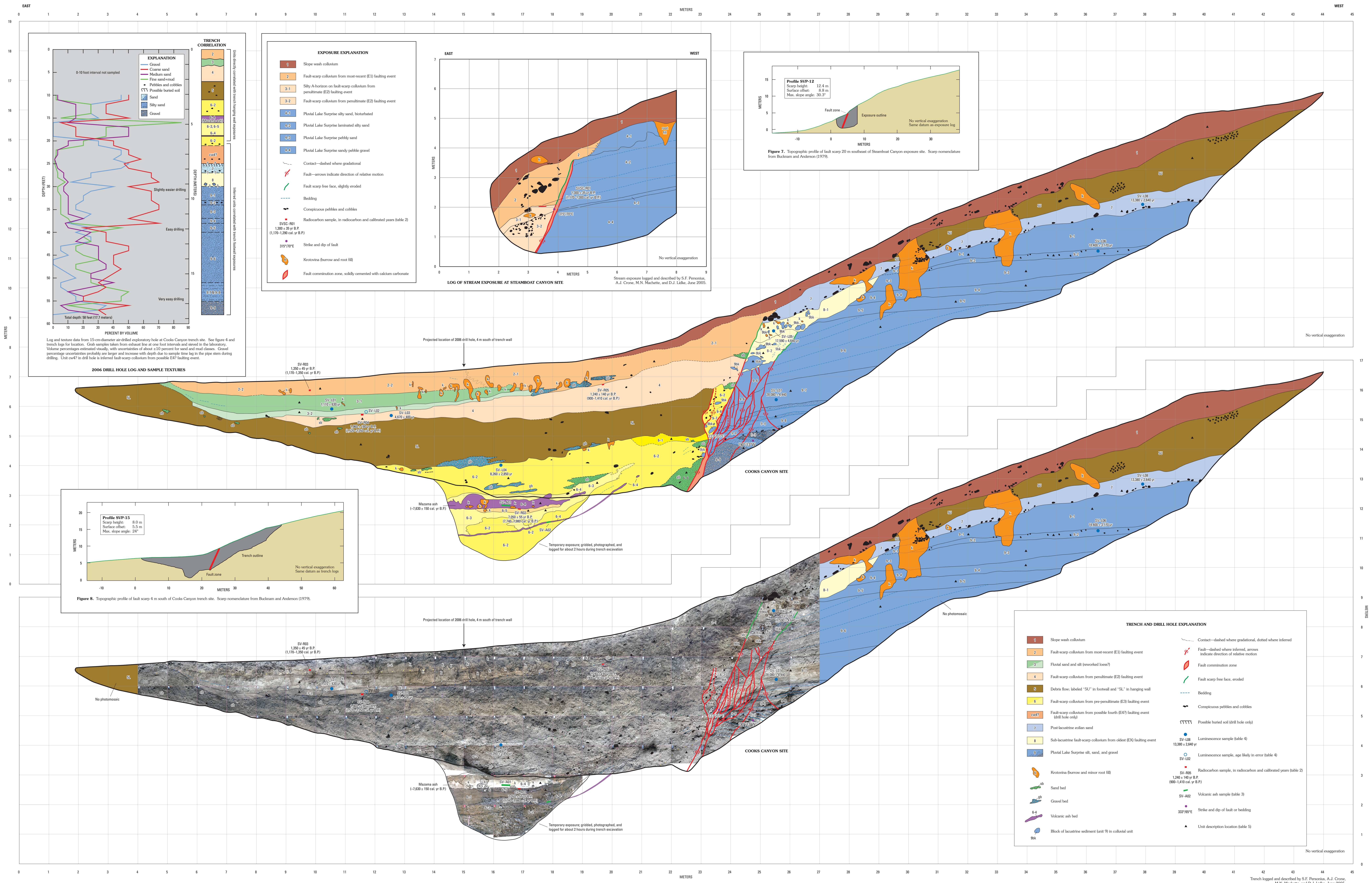

Figure 7. Topographic profile of fault scarp 20 m southeast of Steamboat Canyon exposure site. Scarp nomenclature from Bucknam and Anderson (1979).

Figure 8. Topographic profile of fault scarp 4 m south of Cooks Canyon trench site. Scarp nomenclature from Bucknam and Anderson (1979).

Trench logged and described by S.F. Personius, A.J. Crone, M.N. Machette, and D.J. Lidke, June 2005.

LOGS OF TRENCH AND DRILL HOLE AT COOKS CANYON SITE AND LOG OF STREAM EXPOSURE AT STEAMBOAT CANYON SITE (TRENCH LOGS SHOWN WITH AND WITHOUT PHOTOMOSAICS)

LOGS AND SCARP DATA FROM A PALEOSEISMIC INVESTIGATION OF THE SURPRISE VALLEY FAULT ZONE, MODOC COUNTY, CALIFORNIA

By
Stephen F. Personius, Anthony J. Crone, Michael N. Machette, David J. Lidke, Lee-Ann Bradley, and Shannon A. Mahan
2007

Publishing support provided by:
Denver Publishing Service Center

For more information concerning this publication, contact:
Team Chief Scientist, USGS Geologic Hazards
Box 25046, Mail Stop 966
Denver, CO 80225
(303)273-8579

Or visit the Geologic Hazards Team Web site at:
http://geohazards.cr.usgs.gov/

Suggested citation:
Personius, S.F., Crone, A.J., Machette, M.N., Lidke, D.J., Bradley, L.-A., and Mahan, S.A., 2007, Logs and scarp data from a paleoseismic investigation of the Surprise Valley fault zone, Modoc County, California: U.S. Geological Survey Scientific Investigations Map 2983, 2 sheets.

Manuscript approved for publication October 1, 2007
Minor revisions dated July 7, 2008

This map was produced on request, directly from digital files, on an electronic plotter

For sale by U.S. Geological Survey Information Services, Box 25286, Federal Center, Denver, CO 80225

1-888-ASK-USGS

A PDF for this map is available at http://pubs.usgs.gov/sim/2983