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SCIENTIFIC INVESTIGATIONS MAP 2815
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INTRODUCTION

This report contains field and laboratory data from a trench study of the Santa Rosa Range fault zone near Orovada, Nevada. The fault zone bounds the western margin of the Santa Rosa Range and the eastern margin of the Quinn River Valley in the Basin and Range province of northern Nevada and southeastern Oregon. The trench was excavated in June, 2001, as part of paleoseismic investigations (Personius and others, 2002a, 2002b) of Quaternary faults along several recently established geodetic transects in the northern Basin and Range (for example, Thatcher and others, 1999). Although several investigations of Quaternary faulting have been conducted along the Santa Rosa Range (Dohrenwend and Moring, 1991; Michetti and Wesnousky, 1993; dePolo, 1998; Narwold, 1999, 2001), our study is the first to obtain detailed paleoseismic data from a trench investigation. We located the trench just west of Santa Rosa Peak, the highest point in the footwall of the fault zone, in hopes of obtaining slip and paleoearthquake timing data from the most active part of the fault zone. The trench was excavated across an 8.5-m-high scarp on the westernmost of two strands that form a 1.5-km-wide left step in the range front, 5 km southeast of Orovada. The scarp crosses an alluvial-fan complex that emanates from several canyons along this part of the Santa Rosa Range. Luminescence dating indicates that the faulted fan is at least as old as the Eetza cycle (MIS 6; Adams and Wesnousky, 1999) of pluvial Lake Lahontan. The trench exposed a thick sequence of silty colluvium faulted against sandy pebble to boulder gravels that comprise the fan.

The purpose of this report is to present photo mosaics and detailed trench logs, scarp profiles, soils data, gamma-ray spectrometer data, luminescence ages, and detailed unit descriptions obtained in this investigation. We do not attempt to use the primary data presented herein to construct a paleoseismic history of this part of the Santa Rosa Range fault zone; that history will be the subject of a future report.

ACKNOWLEDGMENTS

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THERMOLUMINESCENCE AGE DATA

We used luminescence dating techniques to determine the ages of alluvial-fan and colluvial sediments exposed in the trench. TL (thermoluminescence) and IRSL (infrared stimulated luminescence—a type of optically stimulated luminescence (OSL) unique to feldspars) techniques date the last time sediment is exposed to sunlight, presumably during deposition (Berger, 1988; Forman and others, 2000). Sampling was done at night using tubes of plastic electrical conduit driven into freshly cleaned trench and pit walls; after extraction, sample tubes were sealed with plastic tape and stored in airtight plastic bags. Dose rates were determined in situ with an Exploranium GR-256 gamma ray spectrometer placed in holes drilled in the trench and pit walls near the sample locations. Field moisture contents of 0.1-17 percent by weight were determined for each sample in the laboratory. A polymineralic, fine-silt-size (4-11μm) fraction was isolated for each sample. Samples were subjected to combinations of sunlight sensitivity tests, anomalous fading tests (Wintle, 1973), total bleach and partial bleach experiments (Wintle and Huntley, 1980; Singhvi and others, 1982) for TL, and additive dose experiments for IRSL (Aitken, 1998). Our TL and IRSL ages (see logs and table) are generally consistent and in stratigraphic order. The colluvial deposits exposed in the trench range in age from about 6 ka to about 140 ka. The loess deposits in the pit range in age from about 10 ka to about 120 ka; dating results are less certain for the underlying alluvial-fan deposits, but a single sample from these deposits yielded an age of 330-550 ka.

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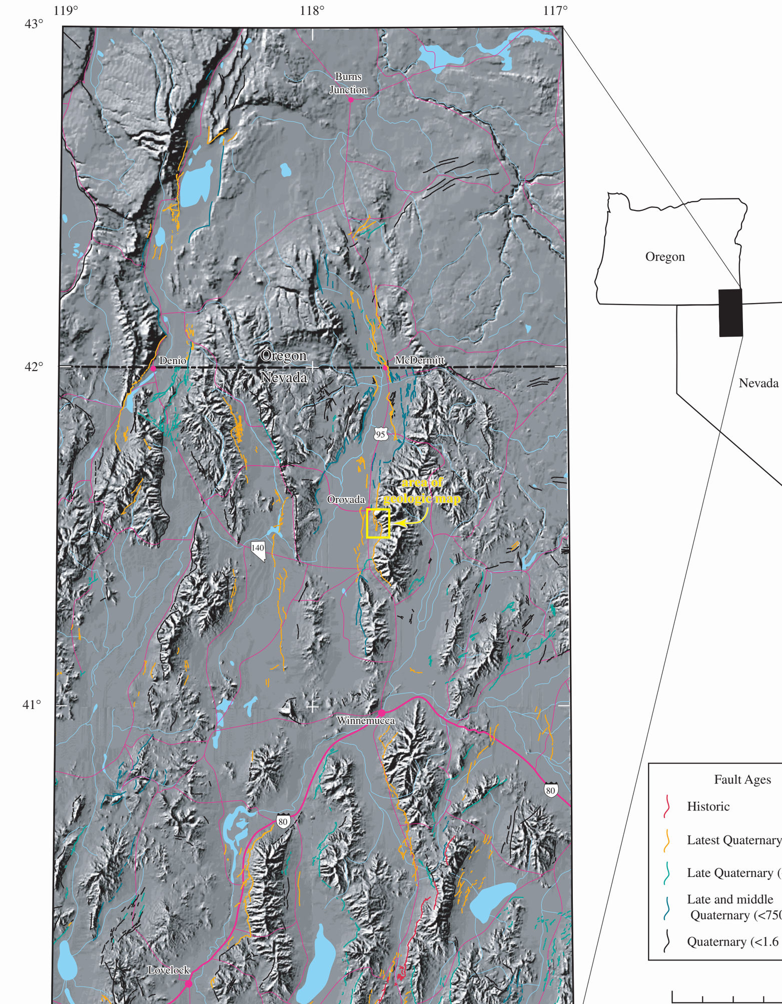
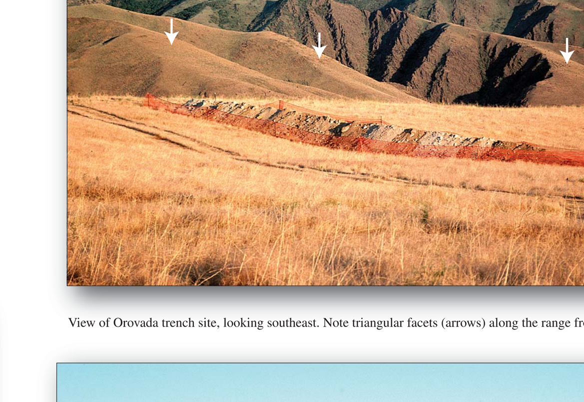
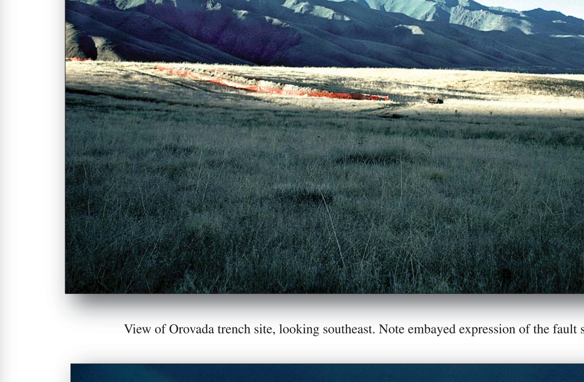


Map of Quaternary faults in the region. Faults in the northern part of the map are from Personius and others (2003); faults in the southern part of the map are from Quaternary fault database of U.S. Geological Survey (Machette and others, 2003).

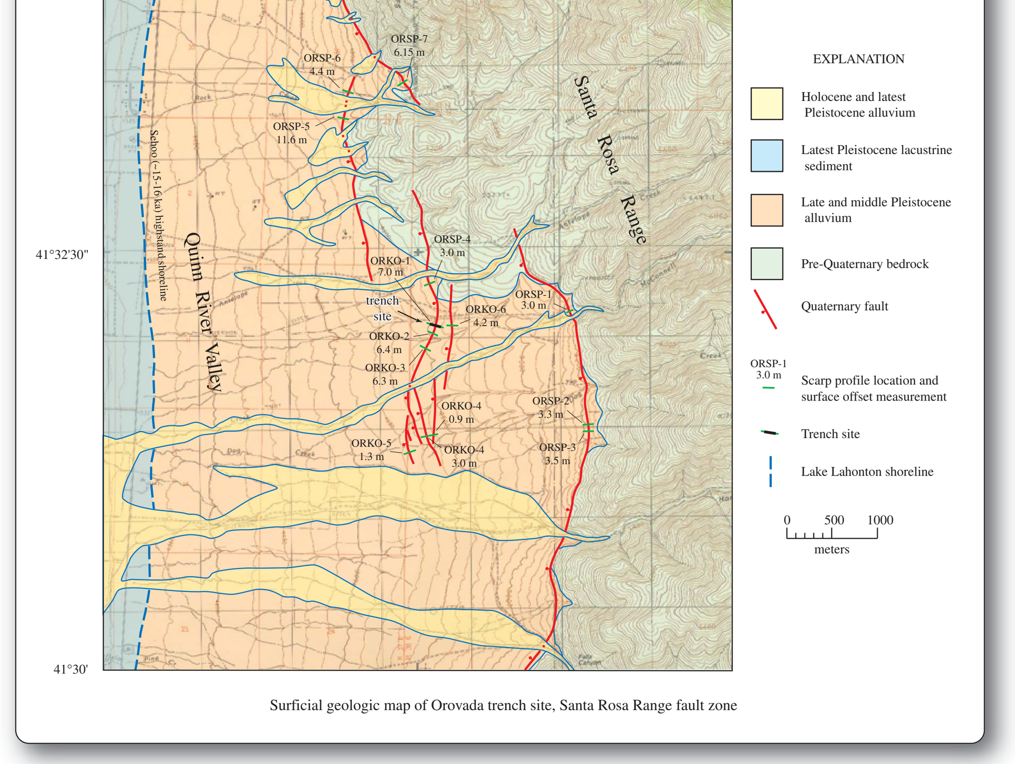


View of Orovada trench site, looking southeast. Note triangular facets (arrows) along the range front in distance.



View of Orovada trench site, looking southeast. Note embayed expression of the fault scarp.

View (looking east) of range front south of Orovada trench site. Note prominent triangular facets, which are typical of this section of the Santa Rosa Range fault zone.

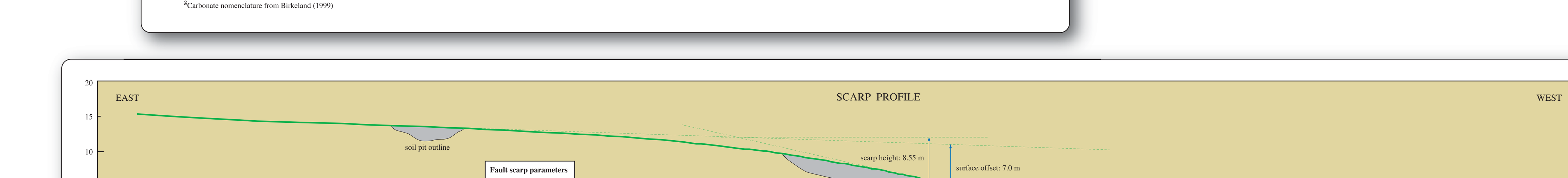


Surficial geologic map of Orovada trench site, Santa Rosa Range fault zone

Soils data from Orovada trench site

Horizon[a]	Unit number	Depth top (cm)	Depth base (cm)	Lower[b] boundary	Color dry	Color moist	Texture[c]	Gravel %	Structure[d]	Dry consistence[e]	Wet consistence[e]	Clay films[f]	Comments[g]
Profile S1—Trench, hanging wall south, location at 10 m horizontal datum													
Av	7a	0	10	as	10YR 6/2	10YR 5/3	SiL	<1	m	so	ss, ps	0	No carbonate; silty colluvium parent material
Bt	7b	10	50	as	10YR 7/3	10YR 6/2	SiCL	<1	1vf, sbk	sh	ss, ps	v1f, pf-po	Weak Bt; no carbonate
2Btbk1	5a	50	70	as	10YR 6/4	10YR 6/3	SCL	2	2f, sbk	vh	s, p	1f, pf-po	Stage I+ carbonate, coatings on ped faces and few small nodules; stony colluvium parent material
2Btbk2	5b	70	90	as	7.5YR 6/4	7.5YR 5/4	SC	2	3f-m, p	eh	vs, vp	3d, pf-po	Stage II- carbonate, few nodules, common filaments, complete coatings on prism faces
2Btbk3	5b	90	125	as	7.5YR 7/3	7.5YR 6/4	CL	2	2vf-f, sbk	h	s, p	1f, pf-po	Stage I carbonate, few filaments
2Bk1	5c	125	160	as	10YR 8/1	10YR 8/3	SiCL	1-2	1vf, sbk	so	ss, ps	0	Stage II+ carbonate, some nodules, most of matrix whitened
2Bk2	5c	160	185	as	10YR 8/2	10YR 7/3	SL	1-2	1vf-f, sbk	so	so, po	0	Stage II carbonate, lots of nodules, matrix 20-50% whitened
3Btbk	4b	185	205+	ND	10YR 8/1	10YR 7/3	L	1	1vf-f, sbk	h	ss, ps	0	Stage II+ carbonate, common filaments and nodules; matrix 50% whitened; silty, sandy colluvium parent material
Profile N1—Trench, footwall north, location at 37.5 m horizontal datum													
Av	7	0	15	as	10YR 6/2	10YR 5/2	SiL	<1	m	so	ss, ps	0	No carbonate; silty colluvium parent material
Bw	7	15	35	as	10YR 6/3	10YR 5/3	SiL	<1	1vf, sbk	sh	ss, ps	0	No carbonate
Bt	7	35	40	as	10YR 6/4	10YR 5/4	SCL	1	2vf-f, sbk	sh-h	s, p	1f, pf-po	Weak Bt; no carbonate
2Btbk	2b	40	70	as	10YR 5/4	10YR 4/4	SCL	10	2vf-f, sbk	h	s, p	2d, pf-po	Stage I carbonate; fan alluvium parent material
2Bk1	2b	70	85	as	10YR 8/2	10YR 7/3	SL	60-70	m	eh	so, po	0	Stage III+ carbonate, matrix completely whitened, complete rinds on clasts, bottom rinds 50-100 mm thick; incipient laminations 1-2 cm thick
2Bk2	2b	85	115	gw	10YR 8/1	10YR 7/3	SL	70-80	m	eh	so, po	0	Stage II+ to III- carbonate, matrix mostly whitened, complete rinds on clasts
2Bk3	2b	115	205+	ND	10YR 7/3	10YR 6/3	S	70-80	m	lo	so, po	0	Weak oxidation, granite clasts weathered to gruss, minor carbonate rinds on bottoms of some clasts
Profile P1—Pit, south wall, location at 93.3 m horizontal datum													
Av	up3	0	15	as	10YR 7/2	10YR 5/3	SL	<1	m	so	so-ss, po	0	Crude, 1-3 cm thick platy bedding; no carbonate; younger loess parent material
Bw	up3	15	45	as	10YR 7/3	10YR 5/4	SL	<1	1vf, sbk	sh	so-ss, po	0	No carbonate
Btk	up3	45	60	as	10YR 7/2	10YR 6/4	SCL	1	1f, sbk	sh-h	s, p	v1f, pf-po	Stage I carbonate, filaments and coatings on ped faces
2Bkb1	up2	60	75	cs	10YR 8/1	10YR 8/3	LS-SL	<1	1f, sbk	so	so, po	0	Stage II+ to III- carbonate, nodules common, 2-3 mm thick filaments, 10-200 cm long, most of matrix whitened; older loess parent material
2Bkb2	up2	75	100	cs	10YR 8/1	10YR 8/2	SL	1	1vf, sbk	so	so, po	0	Stage II carbonate, fewer nodules, most of matrix whitened, similar filaments to above
2Bkb3	up2	100	125	as	10YR 8/2	10YR 7/3	L	2-5	1vf, sbk	so	ss, ps	0	Stage II- carbonate, rare nodules, most of matrix whitened,
3Bkb	up1	125	200+	ND	ND	ND	S	>75	m	lo	so, po	0	Stage I+ carbonate, clasts have thin coats on bottoms; granite clasts weathered to gruss; fan alluvium parent material

[a]Horizon nomenclature from Soil Survey Staff (1975) and Birkeland (1999)
[b]Boundary: distinctness: a--abrupt, c--clear, g--gradual; topography: s--smooth, w--wavy; ND--not determined
[c]Texture classes: CL--clay loam, L--loam, LS--loamy sand, S--sand, SC--sandy clay, SCL--sandy clay loam, SiCL--silty clay loam, SiL--silt loam, SL--sandy loam
[d]Structure: grade: m--massive, 1--weak, 2--moderate, 3--strong; size class: vf--very fine, f--fine, m--medium; type: sbk--subangular blocky, p--prismatic
[e]Consistence: dry: lo--loose, so--soft, sh--slightly hard, h--hard, vh--very hard, eh--extremely hard; wet: so--nonsticky, ss--slightly sticky, s--sticky, vs--very sticky, po--nonplastic, ps--slightly plastic, p--plastic, vp--very plastic
[f]Clay films: amount: 0--none, v1--very few, 1--few, 2--common, 3--many; distinctness: f--faint, d--distinct; location: pf--on ped faces, po--lining pores
[g]Carbonate nomenclature from Birkeland (1999)



Luminescence dose rate data from Orovada trench site

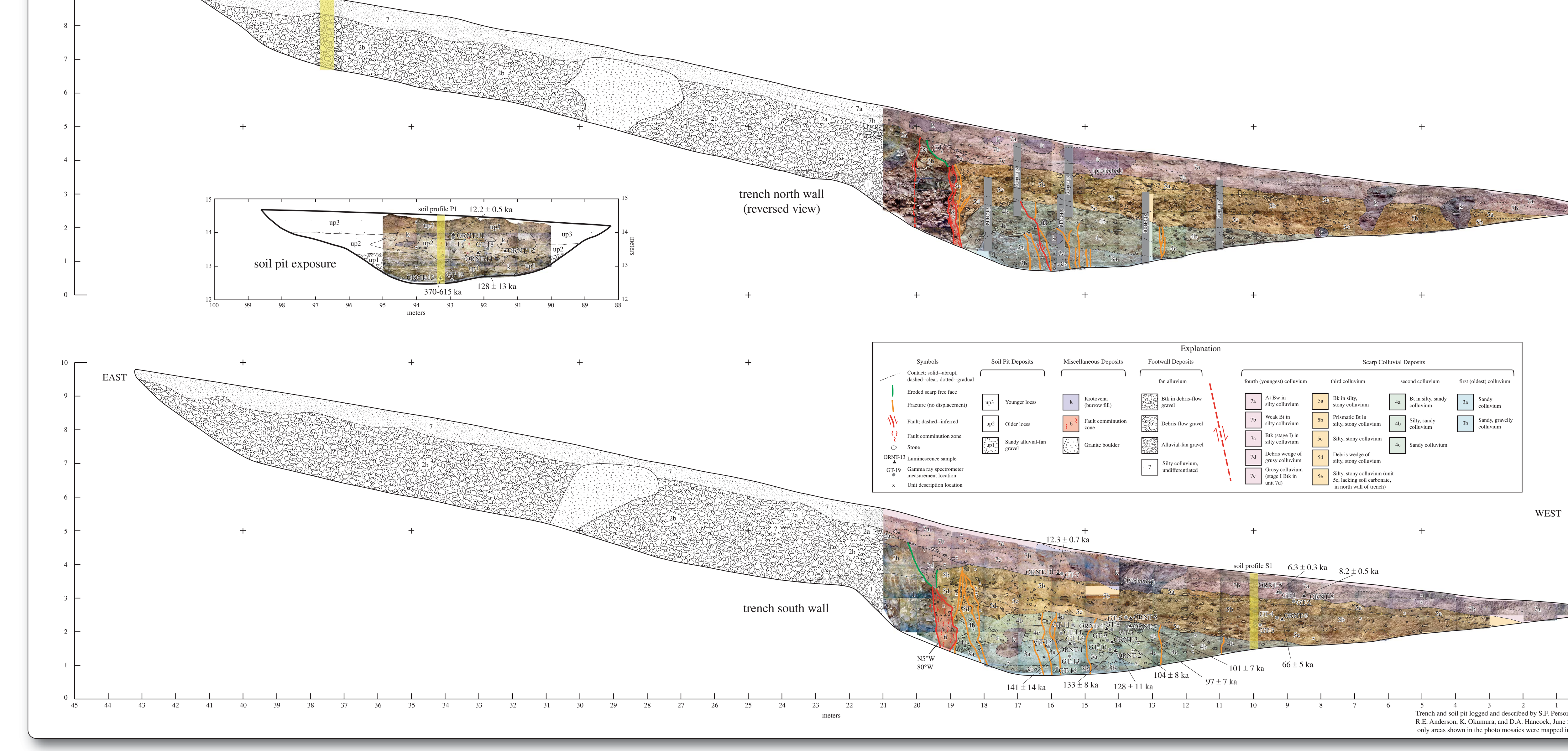
Measurement number	TL sample[a] number	Location[b] x/y (m)	Unit number	K[c] (%)	U[c] (ppm)	Th[c] (ppm)	Depth (cm)	Moisture content[d] (%)	Dose rate[e] (Grays/ka)
GT-12	ORNT-1	15.32, 1.62	3a	1.57	3.38	7.78	280	10	4.38 ± 0.19
GT-13	N/A	15.45, 1.27	3a	1.68	3.59	8.38	325	10	4.66 ± 0.20
GT-15	N/A	16.07, 1.53	3a	1.45	3.55	7.19	310	10	4.26 ± 0.19
GT-16	N/A	15.82, 0.90	3b	1.60	3.65	8.34	370	10	4.59 ± 0.20
GT-5	ORNT-7	13.76, 2.15	4b	1.37	2.57	7.31	200	10	3.76 ± 0.15
GT-8	ORNT-4	14.18, 2.05	4b	1.26	2.72	6.66	220	10	3.63 ± 0.15
GT-11	N/A	15.34, 2.18	4b	1.11	2.81	5.89	230	10	3.42 ± 0.14
GT-9	ORNT-3	14.32, 1.69	4c	1.16	3.20	5.82	260	10	3.64 ± 0.14
GT-10	ORNT-2	14.2, 1.42	4c	1.49	3.09	7.33	280	10	4.11 ± 0.17
GT-14	N/A	15.71, 1.93	4c	1.18	3.60	6.26	260	10	3.91 ± 0.16
GT-2	N/A	8.77, 2.90	5a	1.74	3.62	10.18	75	10	5.04 ± 0.21
GT-4	ORNT-9	9.28, 2.38	5b	1.68	3.32	9.63	130	10	4.75 ± 0.19
GT-3	N/A	9.77, 2.20	5c	1.58	3.02	9.30	150	10	4.46 ± 0.18
GT-6	ORNT-8	13.78, 2.42	5c	1.36	2.81	7.73	180	10	3.93 ± 0.16
GT-1	ORNT-5, 6	9.19, 3.14	7b	1.90	3.42	9.05	60	10	4.96 ± 0.19
GT-7	ORNT-10	15.70, 3.70	7c	1.80	3.61	9.69	80	10	5.03 ± 0.20
GT-17	ORNT-11	92.94, 13.83 P	up3	1.53	3.04	6.52	60	10	4.07 ± 0.15
GT-18	ORNT-14	91.88, 13.52 P	up2	0.99	2.90	5.11	110	10	3.28 ± 0.13
GT-19	ORNT-13	92.95, 12.60 P	up1	1.91	3.66	9.39	180	10	5.09 ± 0.20

[a]N/A--measurements not used in dating analysis
[b]All measurements taken in south wall of trench or pit; pit locations labeled "P"
[c]Amounts of potassium, uranium, and thorium measured in situ with Exploranium GR-256 gamma-ray spectrometer, inserted into 15-cm-wide, 45-cm-deep holes bored into trench wall
[d]All moisture contents normalized to 10%
[e]Dose rates were calculated using normalized moisture contents, so they may differ from dose rates used in the dating analysis; errors are ±1 sigma

Luminescence sample data from Orovada trench site

Sample number	Location x/y (m)	Unit number	Dating[a] method	Temperature[b] data (°C)	Equivalent[c] dose (Grays)	Dose rate[d] (Grays/ka)	Field moisture[e] (%)	TL or IRSL age[f] (ka)	Preferred age estimate[g] (ka)	Comments
ORNT-5	9.28, 3.16	7b	TL-tb	200-280	30.48 ± 0.43	4.48 ± 0.21	4	**6.8 ± 0.6**	6.3 ± 0.3	Average of four ages
			TL-tb	300-400	37.74 ± 0.63	4.48 ± 0.21	4	**8.4 ± 0.7**		
			IRSL	140/7 hrs	23.67 ± 0.22	4.48 ± 0.21	4	**5.3 ± 0.4**		
			IRSL	124/64 hrs	28.77 ± 0.27	4.48 ± 0.21	4	**6.4 ± 0.5**		
ORNT-6	8.55, 2.98	7b	TL-tb	200-300	35.41 ± 0.48	4.47 ± 0.19	10	**7.9 ± 0.7**	8.2 ± 0.5	Average of TL and IRSL ages
			IRSL	140/7 hrs	38.13 ± 0.32	4.47 ± 0.19	10	**8.5 ± 0.7**		
ORNT-11	92.95, 13.88	up3	TL-tb	200-330	49.71 ± 0.72	3.68 ± 0.17	4	**13.5 ± 1.1**	12.2 ± 0.5	Average of four ages; soil pit sample
			TL-tb	220-340	46.11 ± 0.78	3.68 ± 0.17	4	**12.5 ± 1.1**		
			IRSL	124/69 hrs	45.29 ± 0.41	3.68 ± 0.17	4	**12.3 ± 1.0**		
			IRSL	124/64 hrs	39.98 ± 0.83	3.68 ± 0.17	4	**10.9 ± 1.0**		
ORNT-10	15.80, 3.7 0	7c	TL-tb	200-330	63.39 ± 0.56	4.54 ± 0.21	5	**14.0 ± 1.2**	12.3 ± 0.7	Average of TL and IRSL ages
			IRSL	124/64 hrs	51.41 ± 0.36	4.54 ± 0.21	5	**11.3 ± 0.9**		
ORNT-9	9.14, 2.36	5b	TL-tb	multiple plateaus	476.95 ± 8.97	4.29 ± 0.19	7	111 ± 10		First pass; multiple plateaus indicate mixing.
			TL-tb	no plateau	576.73 ± 13.0	4.29 ± 0.19	7	134 ± 12		Second pass; too old, no plateau.
			IRSL	140/6 hrs	275.80 ± 11.2	4.29 ± 0.19	7	**64 ± 6**	66 ± 5	Average of two IRSL ages; mixed sample?
			IRSL	124/64 hrs	292.60 ± 7.17	4.29 ± 0.19	7	**68 ± 7**		
ORNT-8	13.63, 2.38	5c	TL-tb	270-340	346.18 ± 11.1	3.55 ± 0.16	9	**98 ± 10**	101 ± 7	Average of TL and IRSL ages
			IRSL	124/62 hrs	369.66 ± 4.32	3.55 ± 0.16	9	**104 ± 9**		
ORNT-7	13.65, 2.14	4b	TL-tb	230-380	300.11 ± 5.07	3.40 ± 0.15	10	**88 ± 8**	97 ± 7	Average of two TL ages
			TL-tb	300-370	404.67 ± 14.4	3.40 ± 0.15	10	**119 ± 13**		
ORNT-4	14.35, 2.07	4b	TL-tb	300-350	432.68 ± 27.48	3.28 ± 0.16	4	**132 ± 20**	104 ± 8	Average of TL and IRSL ages
			IRSL	124/66 hrs	321.84 ± 4.96	3.28 ± 0.16	4	**98 ± 9**		
ORNT-3	14.15, 1.63	4c	TL-tb	no plateau	667.68 ± 9.75	3.28 ± 0.15		204 ± 17		No plateau indicates incomplete reset.
			IRSL	124/64 hrs	421.46 ± 5.82	3.28 ± 0.15	3	**128 ±11**	128 ± 11	Very small sample
ORNT-14	92.15, 13.40	up2	TL-tb	320-380	378.41 ± 11.13	2.96 ± 0.13	12	**128 ± 13**	128 ± 13	Preferred age estimate; soil pit sample.
			IRSL	140/6 hrs	308.82 ± 6.70	2.96 ± 0.13	12	104 ± 10		Probable age underestimate
ORNT-2	14.10, 1.33	4c	TL-tb	270-350	542.71± 5.97	3.70 ± 0.17	13	**147 ± 13**	133 ± 8	Average of TL and IRSL ages
			IRSL	140/7 hrs	454.35 ± 3.27	3.70 ± 0.17	13	**123 ± 11**		
ORNT-1	15.45, 1.63	3a	TL-tb	280-400	557.8 ± 12.2	3.95 ± 0.18	17	**141 ± 14**	141 ± 14	Preferred age estimate.
			IRSL	140/6 hrs	389.52 ± 5.96	3.95 ± 0.18	17	>110 ± 10		Minimum age, near saturation
ORNT-13	93.30, 12.65	up1	TL-tb	290-320	2565.32 ± 70.6	4.59 ± 0.23	0.1	**559 ± 55**	370-615	Range of IRSL and TL ages; soil pit sample.
			IRSL	140/7 hrs	1848.25 ± 16.1	4.59 ± 0.23	0.1	**403 ± 34**		No apparent saturation

[a]TL-tb—thermoluminescence—total bleach; IRSL—infrared-stimulated luminescence
[b]Values for TL are plateau temperatures; values for IRSL are preheat temperatures
[c]Error is ± 1 sigma
[d]Dose rate from in-situ measurements with Exploranium GR-256 gamma ray spectrometer at field moisture, then recalculated to 20% moisture; error is ± 1 sigma
[e]All are moisture contents of sealed field samples measured in the laboratory
[f]All ages are ± 2 sigma; bold ages are those used in preferred ages in next column
[g]Preferred ages, single or averaged; averaged ages are error weighted, with ± 2 sigma errors; ages used to select preferred ages are listed in bold in previous column



Log and data from an investigation of the Orovada trench site, Santa Rosa Range fault zone, Humboldt County, Nevada

By
Stephen F. Personius, R. Ernest Anderson, Koji Okumura[1], Shannon A. Mahan, and Dean A. Hancock
2004
U.S. Geological Survey, Denver, CO 80225
[1]also at Department of Geography
Hiroshima University, Higashi-Hiroshima, 739-8522, Japan

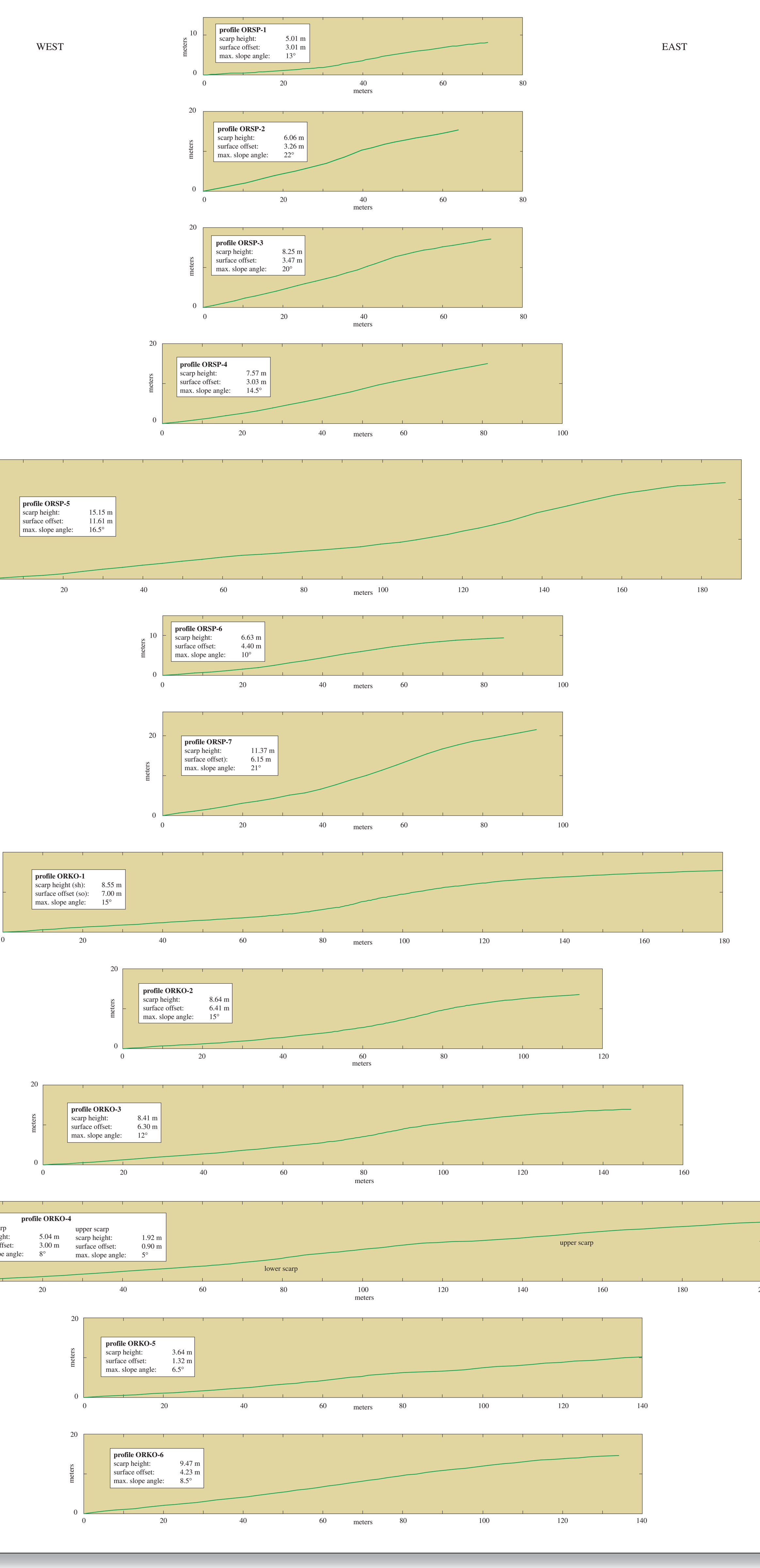
Unit descriptions for Orovada trench site

Unit Number	Location[a] x/y (m)	Matrix grain size	% gravel	Largest clast (mm)	Sorting	Dry color	Dry[b] consistence	Wet[c] consistence	Lower[d] boundary	Soil[e] development	Genesis	Comments
1	19.45, 3.08 N	v cse pebbly sand	85	340	v. poor to unsorted	10YR 6/3 (matrix)	lo	so/po	ne	oxidation, grusification	alluvial fan/debris flow	Some imbrication of platy clasts; clasts platy to subequant; matrix very pebbly
2a	23.2, 5.3 N	v cse granular sand	85		unsorted	7.5YR 5/6 (matrix)	vh-eh	s/p	g	Btk	debris flow	Lower part of stripped Btk in unit 2; minor carbonate on clast faces
2b	22.1, 4.7 N	v cse granular sand	85	700	unsorted	10YR 7/4 (matrix)	lo	so/po	c	oxidation, extensive grusification	debris flow	High energy deposit with boulders to 4 m diameter; minor carbonate on clast faces in upper 50 cm
3a	17.5, 1.75 N	silty granular sand	<1	30	poor	10YR 5/3	eh	so/po	g	Btk	sandy colluvium	Similar brown, patchy, silicious(?) material as unit 3b; looks like Bk but does not contain significant clay
3a	17.18, 1.45 N	silty granular sand	1	30	poor	10YR 8/3	h	so/po	g	Bk (II)	sandy colluvium	Description from 15-cm-thick zone of platy carbonate
3a	17.07, 1.23 N	silty granular sand	5	100	poor	10YR 7/2	sh	vss/po	g	Bk (I)	sandy colluvium	Discontinuous carbonate below platy carbonate zone
3a	17.25, 1.1 S	granular silty sand	<1	40	poor	10YR 8/2	sh	so/po	g	Bk (II)	sandy colluvium	Uniform carbonate accumulation
3b	15.8, 0.9 N	silty granular sand	2	110	poor	10YR 8/2	eh	so/po	ne	Bk (II?)	sandy colluvium	Carbonate increases towards fault zone
3b	16.3, 0.8 S	silty granular sand	5	190	poor	10YR 8/3	vh-eh	so/po	ne	Bk (II?)	sandy colluvium	Grussy matrix in part strongly silica(?) cemented, with small druse-lined vesicles; looks like Bk but does not contain significant clay
4b	10.9, 1.55 N	silty granular sand	2	170	poor	10YR 6/3	so	ss/ps	ne	Btk	mixed silty, sandy colluvium and loess	Carbonate overprinted from overlying Bk in unit 3a
4b	11.7, 1.9 S	slighty silty sand	<1	110	poor	10YR 7/3	eh	so/po	g	Bk	mixed silty, sandy colluvium and loess	Abundant pebbles and granules
4b	11.79, 1.6 S	silty granular sand	1	110	mod	10YR 7/3	sh	ss/ps	g	Bk	mixed silty, sandy colluvium and loess	Numerous 1-2-mm-thick, surface-parallel carbonate bands; sparse angular metasedimentary clasts in sandy matrix
4b	11.82, 1.4 S	silty granular sand		90	mod	10YR 7/3	so/sh	ss/ps	g	Bk	mixed silty, sandy colluvium and loess	Same as above; lower boundary mapped on basis of sandy zone, becomes clear to east
4b	18.15, 2.42 S	granular sandy silt	1	80	mod-poor	10YR 7/3	eh	vss/po	g	Bw	sandy colluvium	Slightly vesicular; carbonate concentrated along irregular network of veins and root casts, matrix carbonate free
4b	18.28, 2.05 S	granular sandy silt	<1	40	mod-poor	10YR 8/2	so	vss/po	g	Bk	sandy colluvium	Strongly calcareous; carbonate increases downward
4c	17.58, 1.8 S	granular sandy silt	1	140	poor	10YR 6/3	vh	so/po	g	Bk?	sandy colluvium	Similar brown, patchy, silicious(?) material as unit 3b; looks like Bk but does not contain significant clay; laced with carbonate
4c	13.4, 1.68 S	silty granular sand	1	60	mod	10YR 7/3	eh	so/po	g	Btk	sandy colluvium	From patch of discontinuous Bt
4c	13.57, 1.44 S	silty granular sand	<1	50	poor	10YR 8/2	vh	so/po	g	Bk	sandy colluvium	Description from 10-cm-thick zone of slightly platy carbonate in sandy bed; carbonate zones pinch out to west
4c	13.47, 1.06 S	silty granular sand	<<1	60	poor	10YR 8/3	so	so/po	g	Bk	sandy colluvium	Finer sand than unit 4b samples above; much less carbonate than unit 4b above
5a	5.5, 2.55 S	silt	2	140	well	10YR 7/3	vh	s/p	c	Btk	silty, stony colluvium	Carbonate on ped faces, stage I; carbonate probably infiltrated from unit 7 above
5b	6.8, 2.4, S	sandy silt	3-4	160	mod-poor	7.5 YR 6/6	eh	vs/vp	g	Btbk	silty, stony colluvium	Strong prismatic structure in upper 20-30 cm; carbonate on ped faces, infiltrated from unit 7 above
5b	18.22, 3.85 S	sandy silt	2	170	mod	10YR 5/6	eh	vs/vp	g	Btbk	silty, stony colluvium	Strong prismatic structure; carbonate on ped faces, infiltrated from unit 7 above; very pebbly
5b	18.10, 3.45 S	sandy silt	10	120	mod	10YR 5/6	sh	s-vs/p-vp	g	Bt	silty, stony colluvium	Less well developed Bt below prismatic Bt in upper part of unit 5b
5c	8.2, 1.8 S	silty sand	2-3	100	mod-poor	10YR 8/1	so	so/po	g	Bk (II+)	sandy colluvium	Wavy upper boundary
5c	18.23, 3.3 S	silty sand	2	50	mod-poor	10YR 6/2	so	s/p	g	Bk (II)	sandy colluvium	Zone of carbonate accumulation; carbonate flushed from unit 5e (not described in detail) in north wall
5d	18.27, 3.14 S	granular silty sand	30	300	poor	10YR 6/3	vh	vss/po	g	Bk	sandy to cobbly colluvium	Very hard, clay poor, suggests possible silica(?) cementation; slightly vesicular; some zones flushed of carbonate
5d	18.08, 2.63 S	granular silty sand	40	300	poor	10YR 7/3	vh	so/po	g	Bk	sandy to cobbly colluvium	Very hard, clay poor, suggests possible silica(?) cementation; non-vesicular; some zones flushed of carbonate
5d	18.77, 3.13 S	silty sand	35	80	poor	10YR 6/3	h	so/po	g	Btk	silty, stony colluvium	Abundant vertical or steeply oriented pebbles, cobbles, veins of carbonate, and carbonate rinds on clast bottoms indicate clast rotation and pervasive shearing
6	18.9, 2.3 N	pebbly silty sand	<1	5	poor	10YR 8/1	lo	so/po	ne	n/a	comminution zone	Loose, silty, pebbly fault gouge; carbonate rich, flushed into zone by shallow groundwater and/or result of crushing Bk horizons or carbonate cemented zones during faulting events; no clear evidence of shear fabric
6	19.2, 2.77 S	pebbly silt	8	65	poor	10YR 6/4	lo	ss/ps	ne	Bt	comminution zone	Loose, silty, pebbly fault gouge; no clear evidence of shear fabric; probably burrowed in upper part
7a	5.0, 3.1 S	silt	<1	30	well	10YR 7/1	sh	ss/ps	g	A/Bw	loess and colluvium	Weak platy structure in upper 10 cm
7a	18.65, 4.9 S	silt	<<1	35	well	10YR 6/4	so	ss/ps	c	A/Bw	loess and colluvium	Weak platy structure, vesicular; insect coprolites
7b	5.0, 2.9 S	silt	<1	50	well	10YR 7/2	sh	ss-s/p	c	Btw	loess and colluvium	Massive
7b	18.55, 4.7 S	silt	<<1	20	well	10YR 6/3	vh	ss-s/ps	c	Btw	loess and colluvium	Vesicular, cohesive; insect coprolites
7c	18.5, 4.4 S	silt	<1	30	well	10YR 6/3	sh	s/p	c	Btk	loess and colluvium	Carbonate on ped faces, stage I
7c	18.8, 4.2 S	granular sandy silt	25	100	mod	10YR 7/3	so	s/p	c	Btk	loess and colluvium	Directly above cobbly stone line at contact with debris wedge (unit 7d); vesicular, carbonate on ped faces
7d	19.15, 4.0 S	cse sand	5-10	20	poor	10YR 6/6	sh	ss/ps	a-c	Bt?	debris wedge colluvium	Mostly grusified pebbles and cobbles in clayey matrix, eroded from exposure of alluvial-fan sediment in scarp
7d	19.25, 4.25 N	med-cse sand	?	25	poor	10YR 6/4	sh	ss-s/ps-p	a-c	Bt?	debris wedge colluvium	Mostly grusified pebbles and cobbles in clayey matrix, eroded from exposure of alluvial-fan sediment in scarp; unit 7e (not described in detail) is same parent material with Btk (stage I) soil
up1	94.0, 13.0 SP	fn-cse sand	70-80	20	poor	n/a	lo	so/po	ne	Bk (I-)	alluvial fan	Soil pit description; well imbricated cobbles indicate fluvial rather than debris flow deposition; very weak soil development
up2	94.0, 13.5 SP	silt	3-5	10	mod-poor	10YR 8/1	so	ss/ps	g	Bk (II)	loess, mixed with alluvium in lower part	Soil pit description; soil development and burial by younger loess suggests deposition from dessication of pre-Sehoo (Eza?) lake cycle
up3	94.0, 14.3 SP	silt	<1	2	mod-well	10YR 7/2	sh	s/p	c	Btk (I+)	loess	Soil pit description; landscape position and soil development suggests deposition from dessication of Sehoo lake cycle

[a]Location: N—north wall, S—south wall, SP—south wall of soil pit
[b]dry consistence: lo—loose, so—soft, sh—slightly hard, h—hard, vh—very hard, eh—extremely hard
[c]wet consistence: so—nonsticky, ss—slightly sticky, s—sticky, vs—very sticky; po—nonplastic, ps—slightly plastic, p—plastic, vp—very plastic
[d]lower boundary: distinctness; a—abrupt <1 cm), c—clear (1-5 cm), g—gradual (>5 cm), ne—not exposed
[e]maximum soil development in unit at this location; roman numerals are stage of carbonate morphology; n/a—not applicable

Fault scarp profile data from Orovada area

[Profile numbers beginning with "ORSP" were surveyed with tape, stadia rod, and Abney level; profile numbers beginning with "ORKO" were surveyed with total station; see surficial geologic map for profile locations; no vertical exaggeration]



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