Appendix A

Final OSL Age Report

USU LUMINESCENCE LABORATORY
1770 north research park way, suite 123, north logan, ut, 84341

Project: **Baja Active Tectonics, Paul Umhoefer**
Report Date: 21 October 2008
Compiled by: Tammy Rittenour

Optically Stimulated Luminescence Age Information

Sample #	USU #	depth (m)	# disks*	dose rate (Gy/ka)	De, Gy (SD)	OSL age (ka)	
SJM-040807-9A	USU-161	1.0	**26** (33)	3.10 ± 0.13	67.02 ± 15.70	**21.62 ± 1.44**	
SJM-040807-9C	USU-162	1.3	**26** (33)	3.52 ± 0.15	83.16 ± 19.26	**23.62 ± 1.58**	
SJM-040807-10A	USU-163	1.4	**20** (27)	3.25 ± 0.14	59.64 ± 18.05	**18.35 ± 1.53**	
SJM-040807-10B	USU-164	1.8	**21** (43)	3.20 ± 0.14	68.01 ± 11.27	**21.26 ± 1.29**	DS
AUS-02	USU-165	1.1	**20** (35)	3.15 ± 0.13	11.71 ± 4.15	**3.72 ± 0.34**	DS
AUS-03	USU-166	0.7	**26** (35)	3.02 ± 0.12	6.33 ± 2.24	**2.10 ± 0.18**	DS
SJM-040207-8A	USU-167	0.96	**24** (38)	3.02 ± 0.12	3.88 ± 1.69	**1.28 ± 0.13**	DS
SJM-011707-5A	USU-168	3.0	**21** (30)	3.00 ± 0.12	22.27 ± 6.13	**7.42 ± 0.57**	DS
MMDB-41007-2A	USU-169	7.94	**21** (65)	2.79 ± 0.12	39.38 ± 18.12	**14.11 ± 6.53**	SS
MMDB-41007-1A	USU-170	1.65	**21** (33)	1.97 ± 0.08	26.36 ± 14.71	**13.38 ± 1.75**	
SJM-011607-2D	USU-173	0.80	**21** (25)	3.48 ± 0.15	4.18 ± 1.71	**1.20 ± 0.12**	
SJM-011707-6A	USU-174	1.32	**22** (28)	2.93 ± 0.12	30.88 ± 6.59	**10.54 ± 0.69**	DS
SJM-011607-4A	USU-175	1.10	**24** (25)	3.22 ± 0.13	11.57 ± 2.77	**3.60 ± 0.88**	DS
MMDB-2307-1A	USU-176	0.30	**23** (35)	2.92 ± 0.12	11.41 ± 4.31	**3.90 ± 0.36**	DS
MMDB-41007-1B	USU-177	0.70	**25** (33)	2.42 ± 0.10	9.86 ± 5.06	**4.08 ± 0.46**	
MMDB-2707-2B	USU-197	1.50	**24** (53)	3.12 ± 0.12	20.39 ± 7.69	**6.53 ± 2.48**	SS
MMDB-2807-3A	USU-198	0.32	**20** (25)	3.89 ± 0.15	3.18 ± 2.33	**0.82 ± 0.60**	DS
MMDB-32207-2A	USU-199	1.05	**22** (53)	2.05 ± 0.08	9.56 ± 5.25	**4.65 ± 2.57**	SS
MMDB-2807-5A	USU-200	0.50	--	2.91 ± 0.11	**--** ± **--**	**--** ± **--**	**
MMDB-32107-1A	USU-201	0.50	**20** (34)	3.09 ± 0.13	9.73 ± 4.80	**3.15 ± 1.56**	SS
MMDB-21007-1A	USU-202	1.05	**25** (35)	2.09 ± 0.09	46.42 ± 19.27	**22.16 ± 2.23**	
MMDB-32207-3A	USU-203	0.50	**22** (45)	2.16 ± 0.09	36.75 ± 5.29	**16.99 ± 0.95**	
SJM-011507-1A	USU-204	1.00	**22** (29)	3.30 ± 0.14	45.83 ± 19.02	**13.87 ± 1.40**	DS
SJM-011607-3A	USU-205	0.85	**22** (31)	3.60 ± 0.18	21.92 ± 8.06	**6.09 ± 2.26**	SS
SJM-040807-11A	USU-206	1.30	**21** (29)	3.30 ± 0.14	61.95 ± 17.15	**18.75 ± 1.46**	DS
MMDB-2807-4A	USU-207	0.35		not processed			
Bonfil-A	USU-281	1.5	**24** (34)	2.84 ± 0.12	51.46 ± 7.55	**18.14 ± 1.04**	DS
Bonfil-B	USU-282	1.3	**25** (34)	2.83 ± 0.12	48.55 ± 6.34	**17.14 ± 0.96**	DS

* Number of accepted aliquots and number of aliquots analyzed (in parentheses)

** insufficient luminescence response for dating

DS sample analyzed using a double SAR protocol to remove feldspar signal (following Olley et al. 2004)

SS sample analyzed using a three second, 1% diode short shine to remove ultrafast signal (following Goble and Rittenour, 2006)

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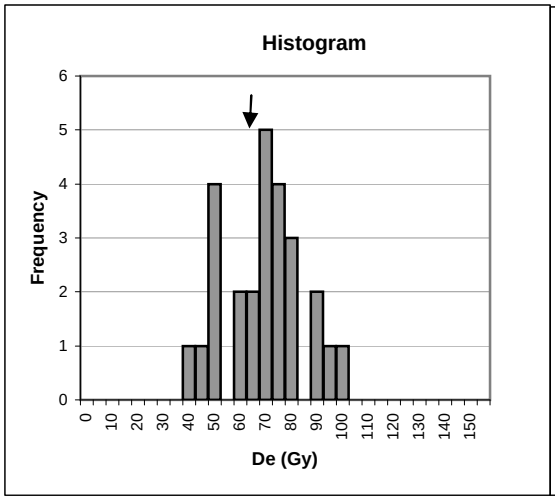
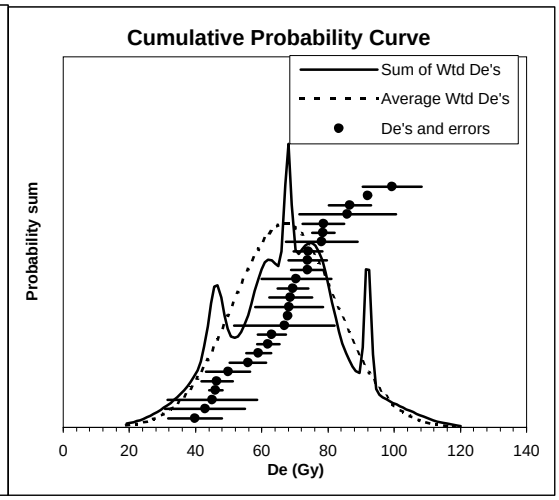
Dose Rate Information

Sample #	USU #	depth (m)	grain size (µm)	in situ H_2O%*	U (ppm)	Th (ppm)	K_20%	Rb_20 (ppm)	cosmic (Gy/ka)	**Dose Rate (Gy/ka)**
SJM-040807-9A	USU-161	1.0	75-125	0.9	4.1±0.29	4.6±0.41	2.04±0.05	65.9±2.6	0.15±0.02	**3.10±0.13**
SJM-040807-9C	USU-162	1.3	75-150	0.8	5.3±0.37	5.6±0.50	2.12±0.05	75.2±3.0	0.16±0.02	**3.52±0.15**
SJM-040807-10A	USU-163	1.4	75-125	1.1	4.7±0.33	5.06±0.45	2.00±0.05	68.1±2.7	0.16±0.02	**3.25±0.14**
SJM-040807-10B	USU-164	1.8	75-125	0.9	4.7±0.33	4.7±0.42	1.98±0.05	65.0±2.6	0.15±0.02	**3.20±0.14**
AUS-02	USU-165	1.1	75-150	1.4	2.4±0.17	5.8±0.52	2.48±0.06	101.0±4.0	0.17±0.02	**3.15±0.13**
AUS-03	USU-166	0.7	75-125	1.4	2.3±0.16	5.5±0.50	2.35±0.06	92.5±3.7	0.18±0.02	**3.02±0.12**
SJM-040207-8A	USU-167	0.96	75-125	1.1	3.5±0.25	4.7±0.42	2.08±0.05	68.9±2.8	0.17±0.02	**3.02±0.12**
SJM-011707-5A	USU-168	3.0	75-125	0.7	2.9±0.20	5.3±0.48	2.24±0.06	76.2±3.0	0.12±0.01	**3.00±0.12**
MMDB-41007-2A	USU-169	7.94	90-250	1.1	0.5±0.10	12.5±1.13	2.22±0.06	60.6±2.4	0.06±0.01	**2.79±0.12**
MMDB-41007-1A	USU-170	1.65	90-250	1.0	0.8±0.10	3.1±0.28	1.78±0.04	60.8±2.4	0.16±0.02	**1.97±0.08**
SJM-011607-2D	USU-173	0.80	75-125	1.0	4.5±0.32	6.1±0.55	2.23±0.06	68.3±2.7	0.18±0.02	**3.48±0.15**
SJM-011707-6A	USU-174	1.32	75-125	0.8	2.5±0.18	6.2±0.56	2.14±0.05	72.1±2.9	0.16±0.02	**2.93±0.12**
SJM-011607-4A	USU-175	1.10	75-125	1.0	3.8±0.27	5.8±0.52	2.18±0.05	72.0±2.9	0.14±0.01	**3.22±0.13**
MMDB-2307-1A	USU-176	0.30	90-180	1.0	1.1±0.10	4.3±0.39	2.75±0.07	90.8±3.7	0.17±0.02	**2.92±0.12**
MMDB-41007-1B	USU-177	0.70	75-250	0.2	0.5±0.10	2.0±0.20	2.43±0.06	63.0±2.5	0.19±0.02	**2.42±0.10**
MMDB-2707-2B	USU-197	1.50	63-250	0.9	1.2±0.10	6.7±0.60	2.79±0.07	100.7±4.0	0.16±0.02	**3.12±0.12**
MMDB-2807-3A	USU-198	0.32	75-180	0.7	3.4±0.24	3.9±0.35	3.26±0.08	118.7±4.7	0.19±0.02	**3.89±0.15**
MMDB-32207-2A	USU-199	1.05	63-250	0.2	1.2±0.10	4.9±0.44	1.59±0.04	54.2±2.2	0.17±0.02	**2.05±0.08**
MMDB-2807-5A	USU-200	0.50	75-250	0.2	0.8±0.10	3.2±0.29	2.92±0.07	105.9±4.2	0.18±0.02	**2.91±0.11**
MMDB-32107-1A	USU-201	0.50	75-250	0.1	1.9±0.13	10.2±0.92	2.22±0.06	72.5±2.9	0.19±0.02	**3.09±0.13**
MMDB-21007-1A	USU-202	1.05	90-250	0.5	1.0±0.10	4.6±0.41	1.73±0.04	55.6±2.2	0.18±0.02	**2.09±0.09**
MMDB-32207-3A	USU-203	0.50	75-250	0.5	1.3±0.10	2.5±0.23	1.88±0.05	55.4±2.2	0.20±0.02	**2.16±0.09**
SJM-011507-1A	USU-204	1.00	75-180	1.0	3.1±0.22	8.7±0.78	2.24±0.06	68.3±2.7	0.17±0.02	**3.30±0.14**
SJM-011607-3A	USU-205	0.85	75-125	1.0	4.0±0.28	6.0±0.54	2.53±0.06	90.4±3.6	0.18±0.02	**3.60±0.18**
SJM-040807-11A	USU-206	1.30	75-125	1.1	4.6±0.32	5.2±0.47	2.07±0.05	72.3±2.9	0.16±0.02	**3.30±0.14**
MMDB-2807-4A	USU-207	0.35	75-250							
Bonfil-A	USU-281	1.5	75-180	2.3	2.7±0.19	7.3±0.66	1.93±0.05	70.5±2.8	0.16±0.02	**2.84±0.12**
Bonfil-B	USU-282	1.3	75-180	2.6	2.6±0.18	7.3±0.66	1.96±0.05	72.6±2.9	0.16±0.02	**2.83±0.12**

* In-situ water content, assumed 2% is more representative of burial history for dose rate calculation, measured values used for USU-281 and USU-282





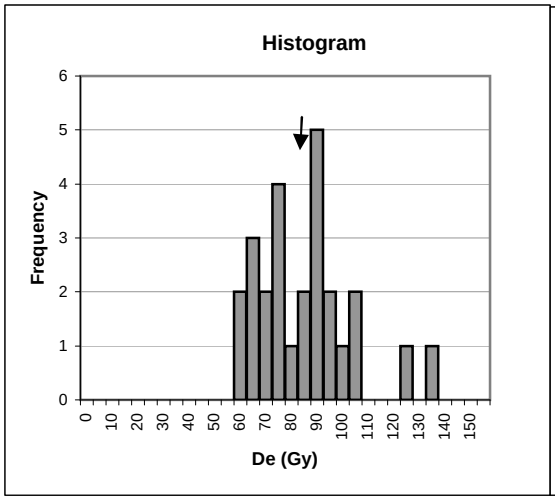
SJM-040807-9A
USU-161

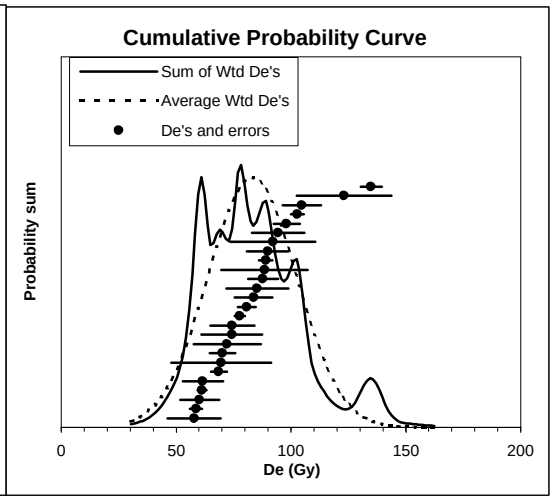
	De (Gy)	±	Age (ka)	±
wt Mean =	**67.02**	**3.08**	**21.62**	**1.44**
Median =	68.44		22.1	1.5
Min =	39.81		12.8	0.9
Max =	99.37		32.0	2.1
S.D. =	15.70			
Standard error =	3.08			
Random Errors=	5.23	%		
Systematic Error=	4.13	%		
Total Error=	6.67	%		
Bin Width =	5	**Gy**		
n =	**26**	**Aliquots**		
		+/-		
dose rate=	**3.10**	**0.13**	**Gy/ka**	
U =	4.10	0.3	**ppm**	
Th =	4.60	0.4	**ppm**	
K2O =	2.04	0.05	**wt. %**	
Rb2O=	65.9	2.6	**ppm**	
H2O=	2.0	2.0	**wt. %**	
Cosmic=	0.15	**Gy/ka**		
depth =	1.0	**m**		
latitude=	14	**degrees (north positive)**		
longitude=	-110	**degrees (east positive)**		
elevation=	0.12	**km asl**		

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
39.81	8.11	12.84	0.86
42.86	12.14	13.83	0.92
45.11	13.56	14.55	0.97
46.07	2.00	14.86	0.99
46.50	4.74	15.00	1.00
49.83	6.72	16.07	1.07
55.80	5.52	18.00	1.20
59.07	3.73	19.05	1.27
61.92	3.37	19.97	1.33
63.01	4.32	20.32	1.36
66.84	15.24	21.56	1.44
67.90	0.97	21.90	1.46
68.21	10.26	22.00	1.47
68.66	6.48	22.14	1.48
69.37	4.67	22.37	1.49
70.47	10.52	22.73	1.52
73.86	5.07	23.82	1.59
73.89	5.77	23.83	1.59
73.99	4.33	23.86	1.59
78.16	10.84	25.21	1.68
78.60	3.42	25.35	1.69
78.63	6.35	25.36	1.69
85.94	14.56	27.72	1.85
86.57	6.36	27.92	1.86
92.02	0.92	29.68	1.98
99.37	8.92	32.05	2.14

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)





SJM-040807-9C
USU-162

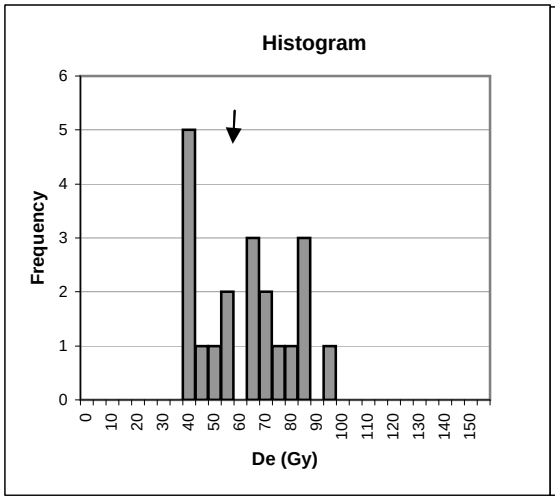
	De (Gy)	±	Age (ka)	±
wt Mean =	**83.16**	**3.78**	**23.62**	**1.58**
Median =	82.31		23.4	1.6
Min =	57.82		16.4	1.1
Max =	134.90		38.3	2.6
S.D. =	19.26			
Standard error =	3.78			
Random Errors=	5.28	%		
Systematic Error=	4.12	%		
Total Error=	6.70	%		
Bin Width =	5	**Gy**		
n =	**26**	**Aliquots**		

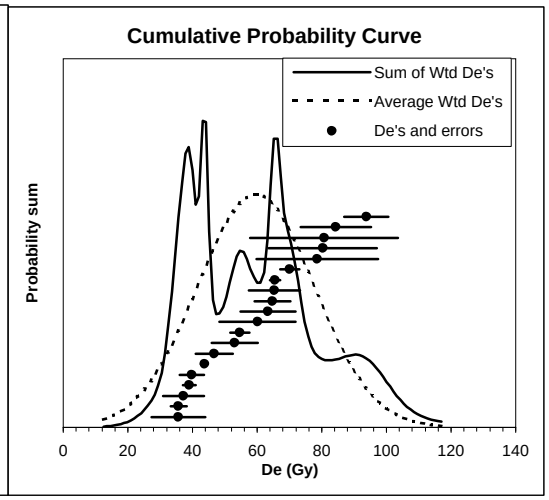
		+/-	
dose rate=	**3.52**	**0.15**	**Gy/ka**
U =	5.30	0.4	**ppm**
Th =	5.60	0.5	**ppm**
K2O =	2.12	0.05	**wt. %**
Rb2O=	75.2	3.0	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.16	**Gy/ka**	
depth =	1.3	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.12	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
57.82	11.51	16.42	1.10
58.70	2.72	16.67	1.12
60.22	8.48	17.10	1.15
61.26	2.06	17.40	1.17
61.62	8.83	17.50	1.17
68.63	3.50	19.49	1.31
69.62	21.68	19.77	1.32
70.29	5.55	19.96	1.34
72.20	14.61	20.50	1.37
74.32	13.22	21.10	1.41
74.49	9.70	21.15	1.42
77.64	2.22	22.05	1.48
80.89	3.89	22.97	1.54
83.73	8.14	23.78	1.59
85.32	13.51	24.23	1.62
87.82	6.50	24.94	1.67
88.47	18.70	25.12	1.68
89.03	2.82	25.28	1.69
89.83	9.02	25.51	1.71
92.18	18.52	26.18	1.75
94.46	11.50	26.82	1.80
98.10	5.68	27.86	1.87
102.86	2.83	29.21	1.96
104.74	8.26	29.74	1.99
123.11	20.58	34.96	2.34
134.90	4.59	38.31	2.57

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)





SJM-040807-10A
USU-163

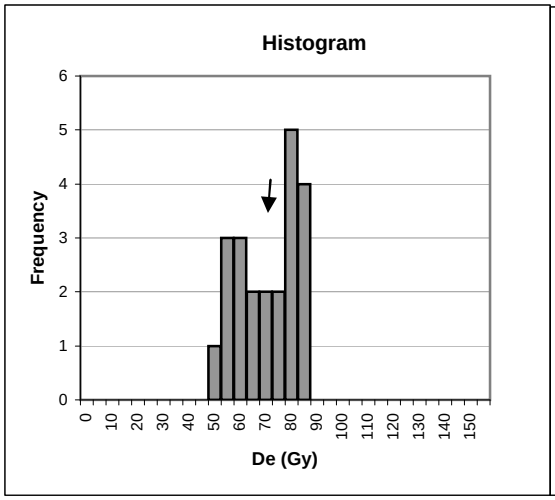
	De (Gy)	±	Age (ka)	±
wt Mean =	**59.64**	**4.04**	**18.35**	**1.53**
Median =	61.75		19.0	1.6
Min =	35.66		11.0	0.9
Max =	93.78		28.9	2.4
S.D. =	18.05			
Standard error =	4.04			
Random Errors=	7.26	%		
Systematic Error=	4.12	%		
Total Error=	8.35	%		
Bin Width =	5	**Gy**		
n =	**20**	**Aliquots**		

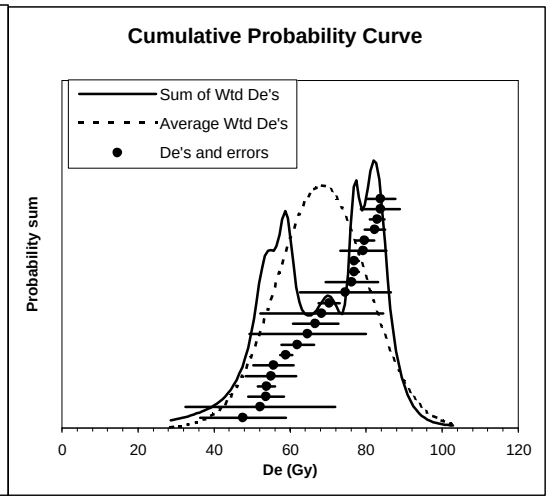
		+/-	
dose rate=	**3.25**	**0.14**	**Gy/ka**
U =	4.70	0.3	**ppm**
Th =	5.00	0.5	**ppm**
K2O =	2.00	0.05	**wt. %**
Rb2O=	68.1	2.7	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.16	**Gy/ka**	
depth =	1.4	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.12	**km asl**	

Indiviual Aliquot Data

De (Gy)	±	Age (ka)	±
35.66	8.39	10.97	0.92
35.68	2.51	10.98	0.92
37.25	6.29	11.46	0.96
39.02	1.94	12.01	1.00
39.76	3.79	12.23	1.02
43.72	1.10	13.45	1.12
46.73	5.68	14.38	1.20
53.13	7.16	16.35	1.36
54.65	3.04	16.82	1.40
60.12	11.81	18.50	1.54
63.38	8.50	19.50	1.63
64.80	5.53	19.94	1.66
65.38	7.89	20.12	1.68
65.58	1.59	20.18	1.68
70.09	2.95	21.57	1.80
78.66	18.86	24.20	2.02
80.30	16.69	24.71	2.06
80.72	22.90	24.84	2.07
84.37	10.94	25.96	2.17
93.78	6.85	28.86	2.41

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)





SJM-040807-10B
USU-164

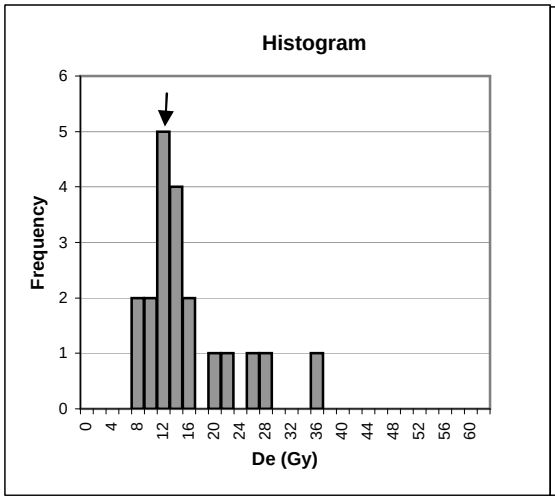
	De (Gy)	±	Age (ka)	±
wt Mean =	**68.01**	**2.46**	**21.26**	**1.29**
Median =	69.26		21.6	1.3
Min =	47.69		14.9	0.9
Max =	83.90		26.2	1.6
S.D. =	11.27			
Standard error =	2.46			
Random Errors=	4.47	%		
Systematic Error=	4.13	%		
Total Error=	6.08	%		
Bin Width =	5	**Gy**		
n =	**21**	**Aliquots**		

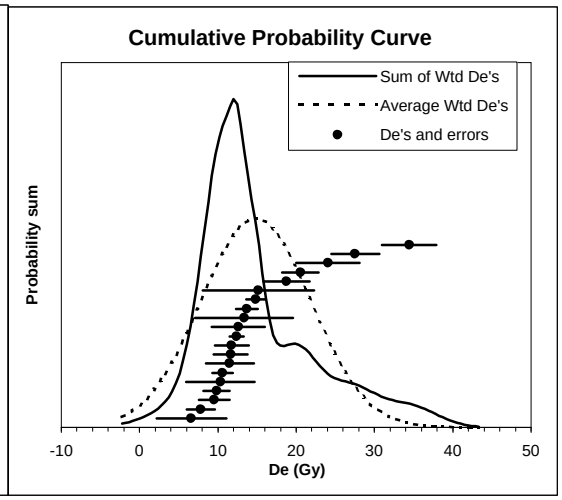
		+/-	
dose rate=	**3.20**	**0.14**	**Gy/ka**
U =	4.70	0.3	**ppm**
Th =	4.70	0.4	**ppm**
K2O =	1.98	0.05	**wt. %**
Rb2O=	65.0	2.6	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.15	**Gy/ka**	
depth =	1.8	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.12	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
47.69	11.28	14.90	0.91
52.18	19.69	16.31	0.99
53.66	4.71	16.77	1.02
53.81	2.30	16.82	1.02
55.01	6.66	17.19	1.05
55.64	5.33	17.39	1.06
58.94	1.62	18.42	1.12
61.99	4.28	19.37	1.18
64.60	15.29	20.19	1.23
66.73	6.02	20.86	1.27
68.26	16.16	21.33	1.30
70.27	2.82	21.96	1.34
74.56	11.91	23.30	1.42
76.26	6.94	23.83	1.45
76.84	1.22	24.02	1.46
76.84	1.22	24.02	1.46
79.29	6.06	24.78	1.51
79.69	2.44	24.91	1.51
82.25	2.71	25.71	1.56
82.90	1.95	25.91	1.58
83.79	5.14	26.19	1.59
83.90	3.71	26.22	1.59

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





AUS-02
USU-165

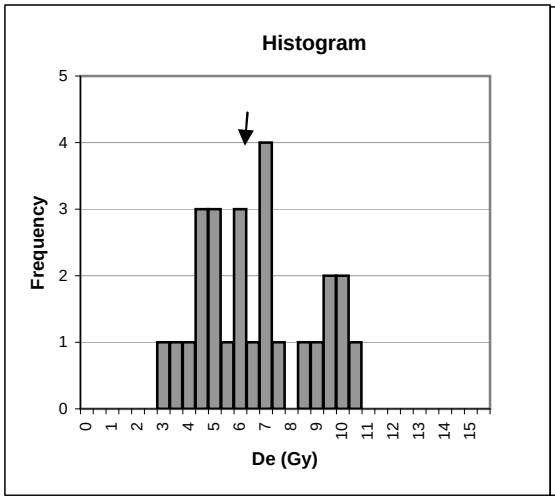
	De (Gy)	±	Age (ka)	±
wt Mean =	**11.71**	**0.93**	**3.72**	**0.34**
Median =	12.51		4.0	0.4
Min =	6.60		2.1	0.2
Max =	34.46		10.9	1.0
S.D. =	7.01			
Standard error =	1.57			
Random Errors=	8.23	%		
Systematic Error=	4.17	%		
Total Error=	9.22	%		
Bin Width =	2	**Gy**		
n =	**20**	**Aliquots**		

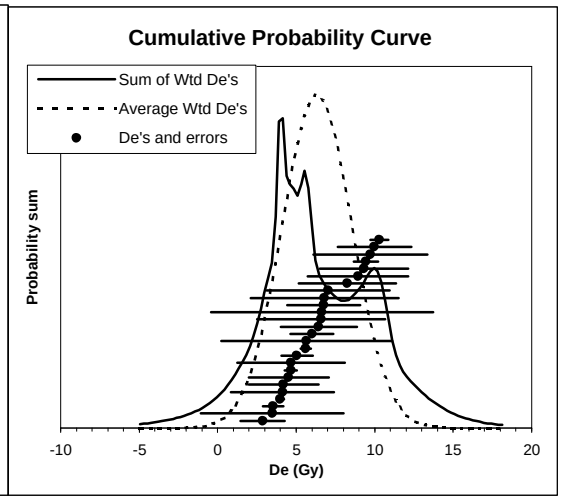
		+/-	
dose rate=	**3.15**	**0.13**	**Gy/ka**
U =	2.40	0.2	**ppm**
Th =	5.80	0.5	**ppm**
K2O =	2.48	0.06	**wt. %**
Rb2O=	101.0	4.0	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.17	**Gy/ka**	
depth =	1.1	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.16	**km asl**	

Individual Aliquot Data

De (Gy)	Error	Age (ka)	±
6.60	4.45	2.10	0.19
7.80	1.79	2.48	0.23
9.54	1.97	3.03	0.28
9.84	1.69	3.13	0.29
10.32	4.39	3.28	0.30
10.63	1.30	3.38	0.31
11.53	3.07	3.66	0.34
11.62	2.17	3.69	0.34
11.78	2.18	3.74	0.35
12.41	0.91	3.94	0.36
12.62	3.40	4.01	0.37
13.36	6.25	4.24	0.39
13.72	1.40	4.36	0.40
14.85	1.21	4.72	0.44
15.20	7.11	4.83	0.45
18.77	2.98	5.96	0.55
20.53	2.37	6.52	0.60
24.06	4.02	7.64	0.70
27.56	3.04	8.75	0.81
34.46	3.48	10.94	1.01

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





AUS-03
USU-166

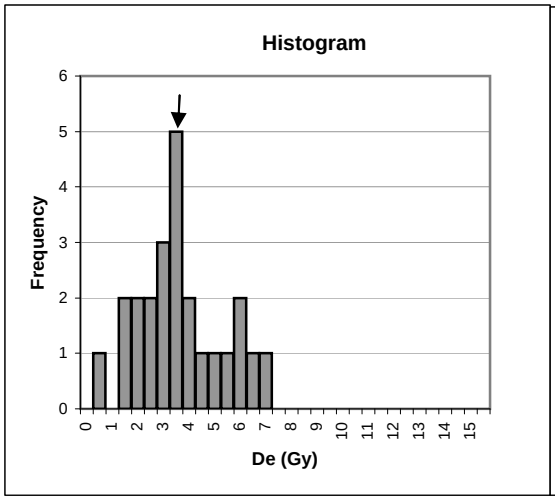
	De (Gy)	±	Age (ka)	±
wt Mean =	**6.33**	**0.44**	**2.10**	**0.18**
Median =	6.22		2.1	0.2
Min =	2.88		1.0	0.1
Max =	10.30		3.4	0.3
S.D. =	2.24			
Standard error =	0.44			
Random Errors=	7.27	%		
Systematic Error=	4.16	%		
Total Error=	8.38	%		
Bin Width =	1	**Gy**		
n =	**26**	**Aliquots**		

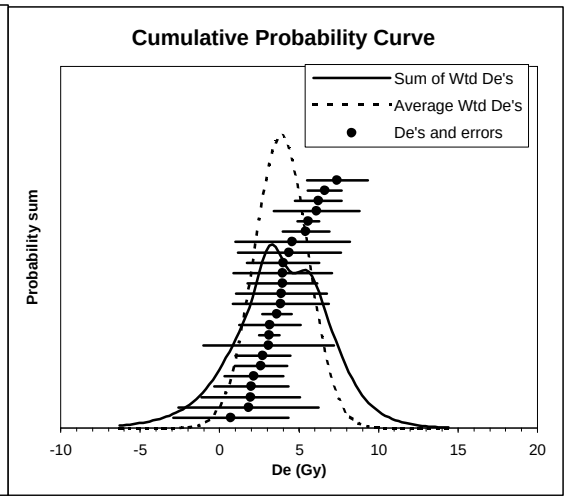
		+/-	
dose rate=	**3.02**	**0.12**	**Gy/ka**
U =	2.30	0.2	**ppm**
Th =	5.50	0.5	**ppm**
K2O =	2.35	0.06	**wt. %**
Rb2O=	92.5	3.7	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.18	**Gy/ka**	
depth =	0.7	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.16	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
2.88	1.40	0.95	0.08
3.47	4.55	1.15	0.10
3.52	0.66	1.17	0.10
4.00	0.21	1.33	0.11
4.12	3.28	1.37	0.11
4.20	2.21	1.39	0.12
4.53	2.55	1.50	0.13
4.65	0.38	1.54	0.13
4.68	3.42	1.55	0.13
5.05	1.00	1.67	0.14
5.59	0.33	1.85	0.16
5.66	5.45	1.87	0.16
6.00	1.36	1.99	0.17
6.44	2.44	2.13	0.18
6.58	4.08	2.18	0.18
6.63	7.07	2.20	0.18
6.76	2.31	2.24	0.19
6.81	4.71	2.26	0.19
7.04	3.92	2.33	0.20
8.27	3.11	2.74	0.23
8.94	3.20	2.96	0.25
9.31	2.82	3.08	0.26
9.44	0.78	3.13	0.26
9.74	3.63	3.23	0.27
9.99	2.33	3.31	0.28
10.30	0.56	3.41	0.29

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





SJM-040207-8A
USU-167

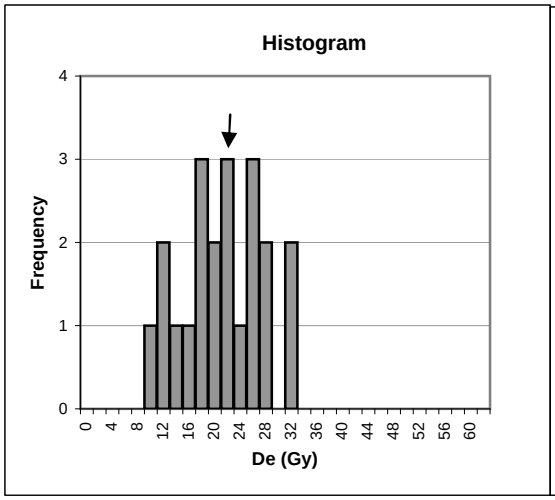
	De (Gy)	±	Age (ka)	±
wt Mean =	**3.88**	**0.34**	**1.28**	**0.13**
Median =	3.87		1.3	0.1
Min =	0.71		0.2	0.0
Max =	7.41		2.5	0.2
S.D. =	1.69			
Standard error =	0.34			
Random Errors=	9.21	%		
Systematic Error=	4.14	%		
Total Error=	10.10	%		
Bin Width =	1	**Gy**		
n =	**24**	**Aliquots**		

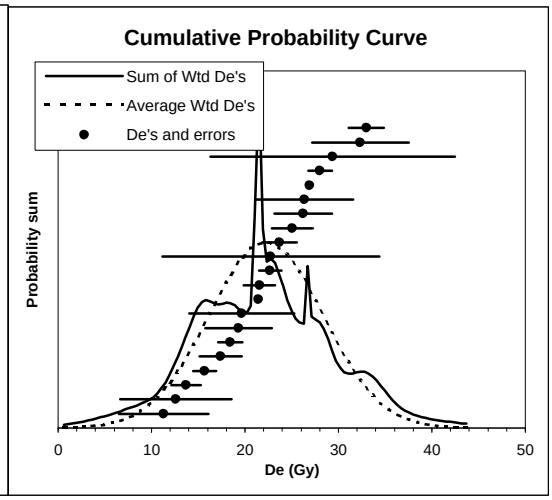
		+/-	
dose rate=	**3.02**	**0.12**	**Gy/ka**
U =	3.50	0.2	**ppm**
Th =	4.70	0.4	**ppm**
K2O =	2.08	0.05	**wt. %**
Rb2O=	68.9	2.8	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.17	**Gy/ka**	
depth =	1.0	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.12	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
0.71	3.62	0.23	0.02
1.83	4.41	0.61	0.06
1.97	3.09	0.65	0.07
2.01	2.34	0.67	0.07
2.16	1.85	0.71	0.07
2.61	1.66	0.86	0.09
2.73	1.73	0.90	0.09
3.10	4.11	1.03	0.10
3.12	0.65	1.03	0.10
3.16	1.94	1.05	0.11
3.62	0.92	1.20	0.12
3.84	3.02	1.27	0.13
3.90	2.85	1.29	0.13
3.96	2.19	1.31	0.13
3.98	3.12	1.32	0.13
4.00	2.28	1.32	0.13
4.39	3.24	1.45	0.15
4.59	3.60	1.52	0.15
5.44	1.48	1.80	0.18
5.59	0.68	1.85	0.19
6.11	2.70	2.02	0.20
6.21	1.49	2.06	0.21
6.62	1.07	2.19	0.22
7.41	1.91	2.45	0.25

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





SJM-011707-5A
USU-168

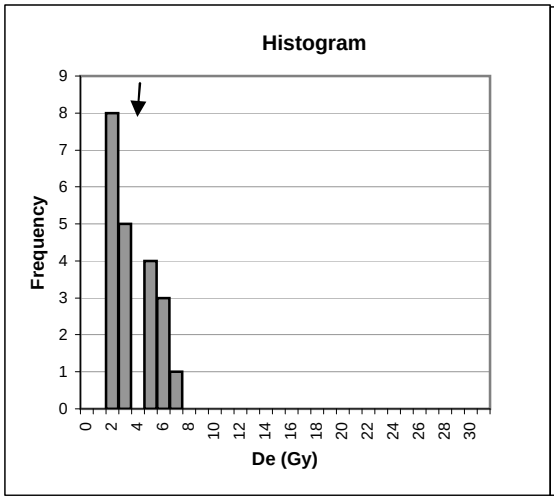
	De (Gy)	±	Age (ka)	±
wt Mean =	**22.27**	**1.34**	**7.42**	**0.57**
Median =	22.70		7.6	0.6
Min =	11.30		3.8	0.3
Max =	32.99		11.0	0.8
S.D. =	6.13			
Standard error =	1.34			
Random Errors=	6.43	%		
Systematic Error=	4.16	%		
Total Error=	7.66	%		
Bin Width =	2	**Gy**		
n =	**21**	**Aliquots**		

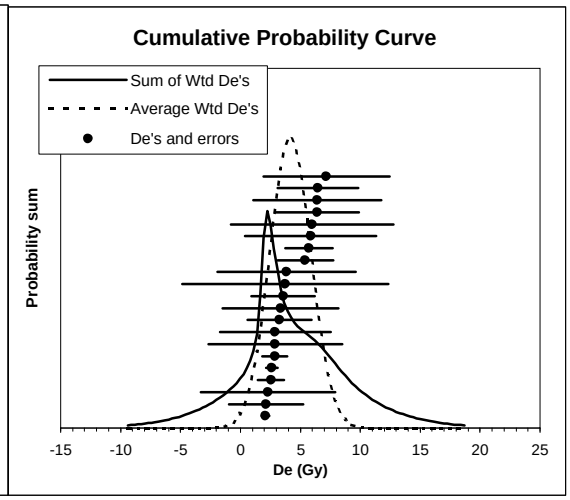
		+/-	
dose rate=	**3.00**	**0.12**	**Gy/ka**
U =	2.90	0.2	**ppm**
Th =	5.30	0.5	**ppm**
K2O =	2.24	0.06	**wt. %**
Rb2O=	76.2	3.0	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.12	**Gy/ka**	
depth =	3.0	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.12	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
11.30	4.82	3.76	0.29
12.61	5.94	4.20	0.32
13.69	1.58	4.56	0.35
15.66	1.23	5.22	0.40
17.41	2.27	5.80	0.44
18.43	1.30	6.14	0.47
19.32	3.54	6.44	0.49
19.65	5.64	6.55	0.50
21.43	0.28	7.14	0.55
21.56	1.69	7.18	0.55
22.70	1.18	7.56	0.58
22.75	11.61	7.58	0.58
23.70	1.85	7.89	0.60
25.07	2.22	8.35	0.64
26.24	3.09	8.74	0.67
26.39	5.15	8.79	0.67
26.89	0.08	8.96	0.69
28.05	1.27	9.34	0.72
29.38	13.07	9.79	0.75
32.34	5.18	10.78	0.83
32.99	1.91	10.99	0.84

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





SJM-011607-2D
USU-173

	De (Gy)	±	Age (ka)	±
wt Mean =	**4.18**	**0.37**	**1.20**	**0.12**
Median =	3.58		1.0	0.1
Min =	2.10		0.6	0.1
Max =	7.18		2.1	0.2
S.D. =	1.71			
Standard error =	0.37			
Random Errors=	9.29	%		
Systematic Error=	4.13	%		
Total Error=	10.17	%		
Bin Width =	1	**Gy**		
n =	**21**	**Aliquots**		

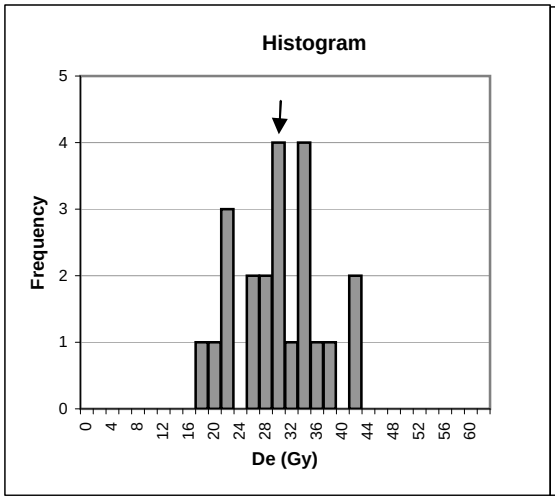
		+/-	
dose rate=	**3.48**	**0.15**	**Gy/ka**
U =	4.50	0.3	**ppm**
Th =	6.10	0.5	**ppm**
K2O =	2.23	0.06	**wt. %**
Rb2O=	68.3	2.7	**ppm**
H2O=	2.0	2.0	**wt. %**

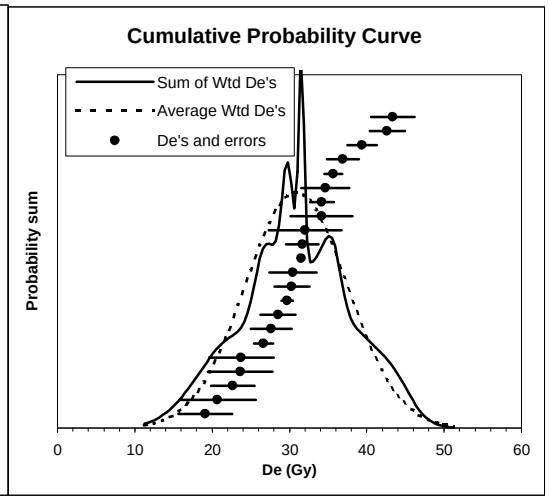
Cosmic=	0.18	**Gy/ka**
depth =	0.8	**m**
latitude=	24	**degrees (north positive)**
longitude=	-110	**degrees (east positive)**
elevation=	0.12	**km asl**

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
2.10	0.33	0.60	0.06
2.15	3.10	0.62	0.06
2.32	5.61	0.67	0.07
2.55	1.11	0.73	0.07
2.61	0.48	0.75	0.08
2.87	1.05	0.83	0.08
2.89	5.58	0.83	0.08
2.91	4.62	0.84	0.09
3.27	2.67	0.94	0.10
3.35	4.83	0.96	0.10
3.58	2.64	1.03	0.10
3.76	8.58	1.08	0.11
3.85	5.76	1.11	0.11
5.42	2.34	1.56	0.16
5.72	2.00	1.64	0.17
5.86	5.47	1.68	0.17
5.99	6.77	1.72	0.18
6.40	3.50	1.84	0.19
6.43	5.32	1.85	0.19
6.47	3.37	1.86	0.19
7.18	5.28	2.07	0.21





SJM-011707-6A
USU-174

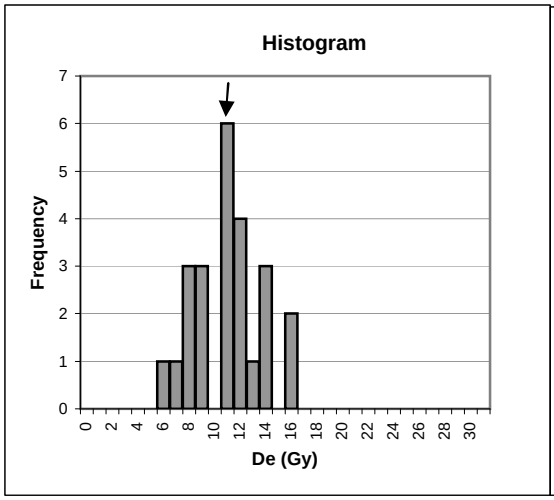
	De (Gy)	±	Age (ka)	±
wt Mean =	**30.88**	**1.40**	**10.54**	**0.69**
Median =	30.99		10.6	0.7
Min =	19.14		6.5	0.4
Max =	43.34		14.8	1.0
S.D. =	6.59			
Standard error =	1.40			
Random Errors=	5.12	%		
Systematic Error=	4.14	%		
Total Error=	6.58	%		
Bin Width =	2	**Gy**		
n =	**22**	**Aliquots**		

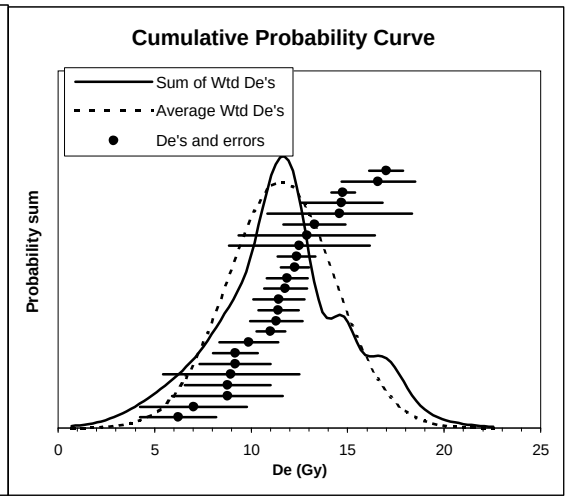
		+/-	
dose rate=	**2.93**	**0.12**	**Gy/ka**
U =	2.50	0.2	**ppm**
Th =	6.20	0.6	**ppm**
K2O =	2.14	0.05	**wt. %**
Rb2O=	72.1	2.9	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.16	**Gy/ka**	
depth =	1.3	**m**	
latitude=	25	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.08	**km asl**	

Individual Aliquot Data

De (Gy)	Error	Age (ka)	±
19.14	3.48	6.53	0.43
20.69	4.94	7.06	0.47
22.71	2.81	7.75	0.51
23.64	4.15	8.07	0.53
23.79	4.19	8.12	0.53
26.65	1.26	9.09	0.60
27.62	2.66	9.43	0.62
28.53	2.28	9.74	0.64
29.73	0.73	10.15	0.67
30.32	2.29	10.35	0.68
30.45	3.04	10.39	0.68
31.54	0.34	10.76	0.71
31.66	2.09	10.81	0.71
32.01	4.71	10.92	0.72
34.16	4.00	11.66	0.77
34.20	1.54	11.67	0.77
34.64	3.13	11.82	0.78
35.64	1.17	12.16	0.80
36.92	2.06	12.60	0.83
39.39	1.89	13.44	0.89
42.66	2.26	14.56	0.96
43.34	2.82	14.79	0.97

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





SJM-011607-4A
USU-175

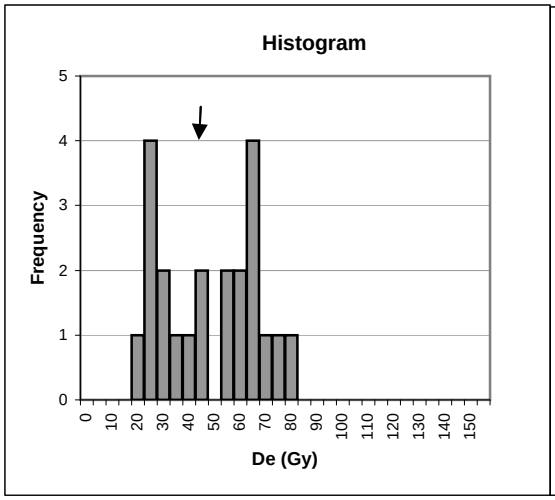
	De (Gy)	±	Age (ka)	±
wt Mean =	**11.57**	**2.77**	**3.60**	**0.88**
Median =	11.61		3.6	0.9
Min =	6.22		1.9	0.5
Max =	17.00		5.3	1.3
S.D. =	2.77			
Standard error =	0.57			
Random Errors=	24.09	%		
Systematic Error=	4.14	%		
Total Error=	24.45	%		
Bin Width =	1	**Gy**		
n =	**24**	**Aliquots**		

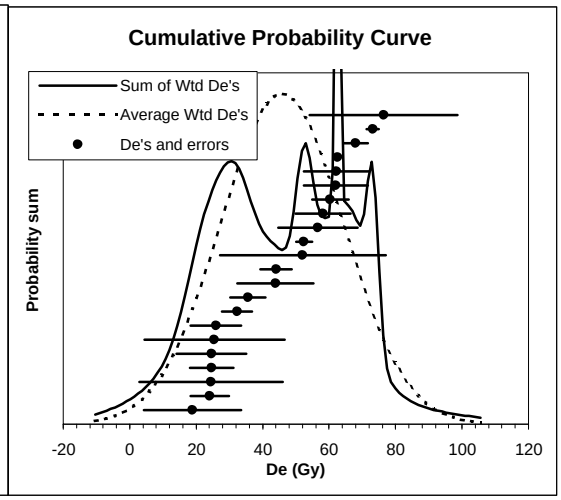
		+/-	
dose rate=	**3.22**	**0.13**	**Gy/ka**
U =	3.80	0.3	**ppm**
Th =	5.80	0.5	**ppm**
K2O =	2.18	0.05	**wt. %**
Rb2O=	72.0	2.9	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.14	**Gy/ka**	
depth =	1.1	**m**	
latitude=	26	**degrees (north positive)**	
longitude=	110	**degrees (east positive)**	
elevation=	0.11	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
6.22	1.99	1.93	0.47
7.02	2.77	2.18	0.53
8.77	2.88	2.73	0.67
8.78	2.22	2.73	0.67
8.97	3.53	2.79	0.68
9.17	1.83	2.85	0.70
9.19	1.15	2.86	0.70
9.89	1.52	3.08	0.75
11.02	0.75	3.43	0.84
11.30	1.35	3.51	0.86
11.42	1.05	3.55	0.87
11.44	1.32	3.56	0.87
11.78	1.11	3.66	0.90
11.87	1.06	3.69	0.90
12.27	0.72	3.81	0.93
12.35	0.98	3.84	0.94
12.49	3.64	3.88	0.95
12.89	3.53	4.01	0.98
13.28	1.61	4.13	1.01
14.58	3.74	4.53	1.11
14.70	2.12	4.57	1.12
14.77	0.61	4.59	1.12
16.59	1.90	5.16	1.26
17.00	0.89	5.28	1.29

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





SJM-011507-1A
USU-204

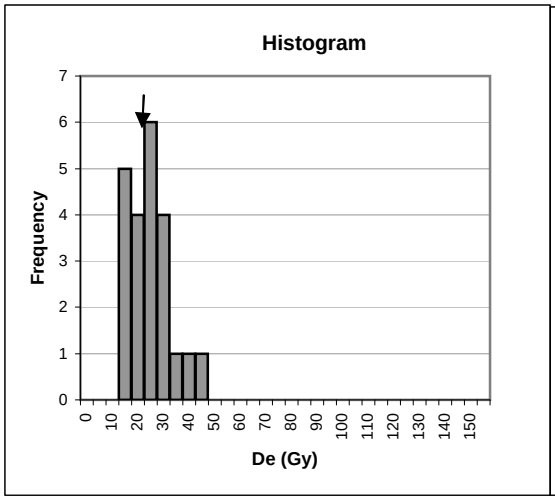
	De (Gy)	±	Age (ka)	±
wt Mean =	**45.83**	**4.05**	**13.87**	**1.40**
Median =	48.11		14.6	1.5
Min =	18.90		5.7	0.6
Max =	76.39		23.1	2.3
S.D. =	19.02			
Standard error =	4.05			
Random Errors=	9.21	%		
Systematic Error=	4.12	%		
Total Error=	10.09	%		
Bin Width =	5	**Gy**		
n =	**22**	**Aliquots**		

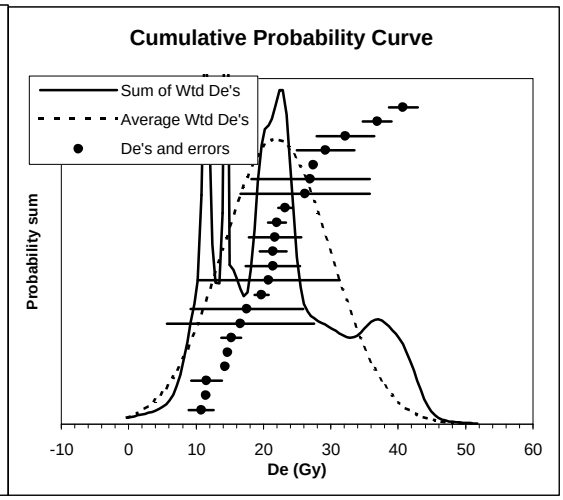
		+/-	
dose rate=	**3.30**	**0.14**	**Gy/ka**
U =	3.10	0.2	**ppm**
Th =	8.70	0.8	**ppm**
K2O =	2.24	0.06	**wt. %**
Rb2O=	68.3	2.7	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.17	**Gy/ka**	
depth =	1.0	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.10	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
18.90	14.62	5.72	0.58
24.11	5.85	7.30	0.74
24.48	21.54	7.41	0.75
24.61	6.54	7.45	0.75
24.63	10.52	7.46	0.75
25.53	21.00	7.73	0.78
25.97	7.63	7.86	0.79
32.30	4.61	9.78	0.99
35.56	5.27	10.77	1.09
43.86	11.40	13.28	1.34
44.10	4.72	13.35	1.35
52.12	24.86	15.78	1.59
52.46	2.42	15.88	1.60
56.65	11.96	17.15	1.73
58.26	8.28	17.64	1.78
60.37	5.51	18.28	1.84
62.00	9.58	18.77	1.89
62.29	9.85	18.86	1.90
62.59	0.70	18.95	1.91
68.01	3.66	20.59	2.08
73.16	1.78	22.15	2.23
76.39	22.24	23.12	2.33

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





SJM-011607-3A
USU-205

	De (Gy)	±	Age (ka)	±
wt Mean =	**21.92**	**8.06**	**6.09**	**2.26**
Median =	21.43		6.0	2.2
Min =	10.76		3.0	1.1
Max =	40.75		11.3	4.2
S.D. =	8.06			
Standard error =	1.72			
Random Errors=	36.84	%		
Systematic Error=	4.91	%		
Total Error=	37.17	%		
Bin Width =	5	**Gy**		
n =	**22**	**Aliquots**		

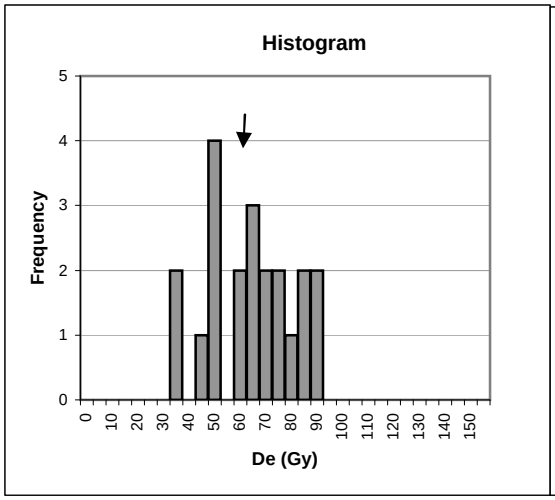
		+/-	
dose rate=	**3.60**	**0.18**	**Gy/ka**
U =	4.00	0.3	**ppm**
Th =	6.00	0.5	**ppm**
K2O =	2.53	0.06	**wt. %**
Rb2O=	90.4	3.6	**ppm**
H2O=	2.0	4.0	**wt. %**

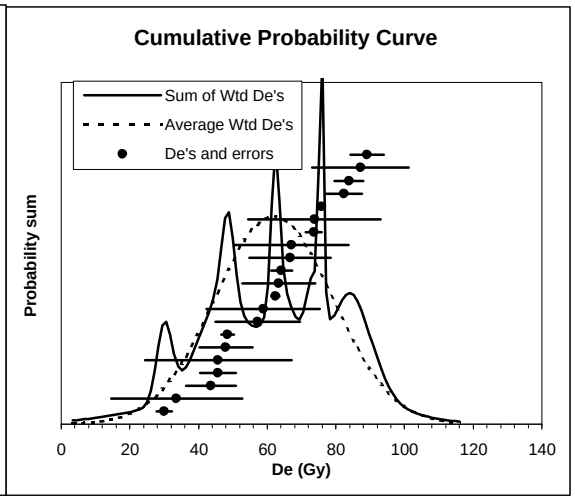
Cosmic=	0.18	**Gy/ka**
depth =	0.9	**m**
latitude=	24	**degrees (north positive)**
longitude=	-110	**degrees (east positive)**
elevation=	0.11	**km asl**

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
10.76	1.83	2.99	1.11
11.47	0.46	3.19	1.18
11.53	2.28	3.20	1.19
14.36	0.19	3.99	1.48
14.69	0.00	4.08	1.52
15.23	1.47	4.23	1.57
16.57	10.91	4.60	1.71
17.55	8.33	4.87	1.81
19.72	1.03	5.48	2.04
20.80	10.56	5.78	2.15
21.41	4.04	5.95	2.21
21.45	1.98	5.96	2.21
21.72	3.86	6.03	2.24
22.05	1.33	6.12	2.28
23.28	1.11	6.47	2.40
26.22	9.58	7.28	2.71
26.98	8.82	7.50	2.79
27.45	0.00	7.63	2.83
29.22	4.29	8.12	3.02
32.20	4.27	8.95	3.32
36.88	2.10	10.24	3.81
40.75	2.11	11.32	4.21

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a three second, 1% diode short shine to remove ultrafast signal (following Goble and Rittenour, 2006)





SJM-040807-11A
USU-206

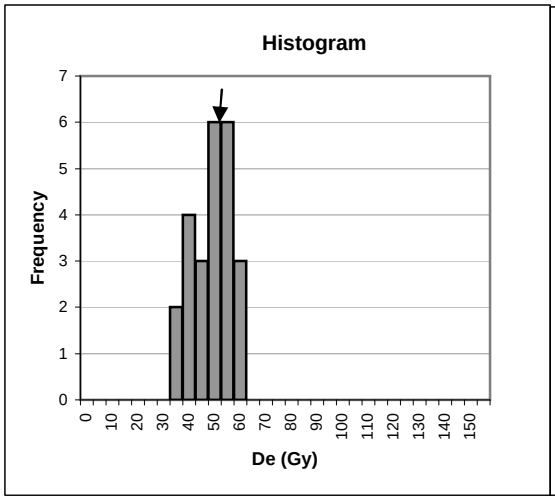
	De (Gy)	±	Age (ka)	±
wt Mean =	**61.95**	**3.74**	**18.75**	**1.46**
Median =	63.36		19.2	1.5
Min =	30.09		9.1	0.7
Max =	89.15		27.0	2.1
S.D. =	17.15			
Standard error =	3.74			
Random Errors=	6.58	%		
Systematic Error=	4.13	%		
Total Error=	7.76	%		
Bin Width =	5	**Gy**		
n =	**21**	**Aliquots**		

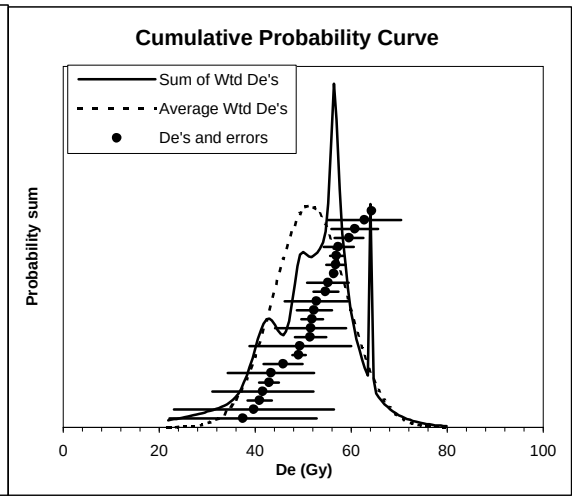
		+/-	
dose rate=	**3.30**	**0.14**	**Gy/ka**
U =	4.60	0.3	**ppm**
Th =	5.20	0.5	**ppm**
K2O =	2.07	0.05	**wt. %**
Rb2O=	72.3	2.9	**ppm**
H2O=	2.0	2.0	**wt. %**
Cosmic=	0.16	**Gy/ka**	
depth =	1.3	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.12	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
30.09	2.23	9.11	0.71
33.64	19.05	10.18	0.79
43.57	7.29	13.19	1.02
45.72	5.24	13.84	1.07
45.76	21.28	13.85	1.08
48.00	7.70	14.53	1.13
48.53	1.88	14.69	1.14
57.18	12.31	17.31	1.34
58.89	16.50	17.83	1.38
62.38	1.17	18.88	1.47
63.36	10.61	19.18	1.49
64.18	3.12	19.43	1.51
66.69	11.85	20.19	1.57
67.16	16.57	20.33	1.58
73.55	2.27	22.27	1.73
73.77	19.27	22.33	1.73
75.82	0.64	22.95	1.78
82.43	5.27	24.95	1.94
83.84	4.17	25.38	1.97
87.16	14.02	26.39	2.05
89.15	4.87	26.99	2.10

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





Bonfil-A
USU-281

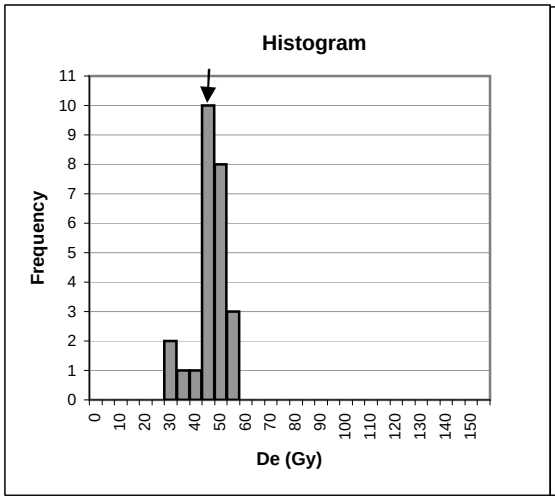
	De (Gy)	±	Age (ka)	±
wt Mean =	**51.46**	**1.54**	**18.14**	**1.04**
Median =	52.08		18.4	1.1
Min =	37.46		13.2	0.8
Max =	64.23		22.6	1.3
S.D. =	7.55			
Standard error =	1.54			
Random Errors=	3.94	%		
Systematic Error=	4.20	%		
Total Error=	5.76	%		
Bin Width =	5	**Gy**		
n =	**24**	**Aliquots**		

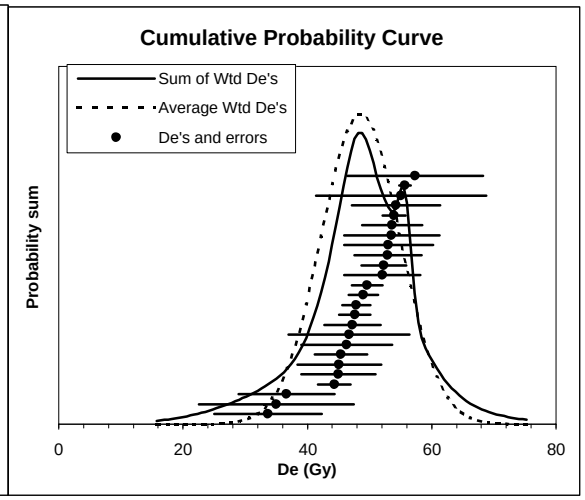
		+/-	
dose rate=	**2.84**	**0.12**	**Gy/ka**
U =	2.70	0.2	**ppm**
Th =	7.30	0.7	**ppm**
K2O =	1.93	0.05	**wt. %**
Rb2O=	70.5	2.8	**ppm**
H2O=	2.3	2.3	**wt. %**
Cosmic=	0.16	**Gy/ka**	
depth =	1.5	**m**	
latitude=	24	**degrees (north positive)**	
longitude=	-110	**degrees (east positive)**	
elevation=	0.10	**km asl**	

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
37.46	15.32	13.20	0.76
39.74	16.68	14.01	0.81
40.88	2.53	14.41	0.83
41.65	10.52	14.68	0.85
42.90	2.07	15.12	0.87
43.30	9.03	15.26	0.88
45.82	4.05	16.15	0.93
49.13	1.36	17.32	1.00
49.36	10.59	17.40	1.00
51.52	3.27	18.16	1.05
51.57	7.42	18.18	1.05
51.87	2.24	18.28	1.05
52.28	3.65	18.43	1.06
52.74	6.61	18.59	1.07
54.73	2.64	19.29	1.11
55.14	4.29	19.43	1.12
56.46	0.63	19.90	1.15
56.85	1.99	20.04	1.15
56.99	1.35	20.09	1.16
57.36	3.14	20.22	1.16
59.56	2.99	20.99	1.21
60.78	4.87	21.42	1.23
62.76	7.59	22.12	1.27
64.23	0.13	22.64	1.30

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)





Bonfil-B
USU-282

	De (Gy)	±	Age (ka)	±
wt Mean =	**48.55**	**1.27**	**17.14**	**0.96**
Median =	49.01		17.3	1.0
Min =	33.65		11.9	0.7
Max =	57.36		20.2	1.1
S.D. =	6.34			
Standard error =	1.27			
Random Errors=	3.63	%		
Systematic Error=	4.30	%		
Total Error=	5.63	%		
Bin Width =	5	**Gy**		
n =	**25**	**Aliquots**		

		+/-	
dose rate=	**2.83**	**0.12**	**Gy/ka**
U =	2.60	0.2	**ppm**
Th =	7.30	0.7	**ppm**
K2O =	1.96	0.05	**wt. %**
Rb2O=	72.6	2.9	**ppm**
H2O=	2.6	2.6	**wt. %**

Cosmic=	0.16	**Gy/ka**
depth =	1.5	**m**
latitude=	24	**degrees (north positive)**
longitude=	-110	**degrees (east positive)**
elevation=	0.10	**km asl**

Individual Aliquot Data

De (Gy)	±	Age (ka)	±
33.65	8.63	11.88	0.67
34.96	12.46	12.34	0.69
36.66	7.76	12.94	0.73
44.34	2.66	15.65	0.88
45.02	5.97	15.89	0.89
45.14	6.77	15.93	0.90
45.41	4.20	16.03	0.90
46.33	7.28	16.35	0.92
46.73	9.73	16.50	0.93
47.26	4.53	16.68	0.94
47.63	2.55	16.81	0.95
47.84	2.28	16.89	0.95
49.01	2.41	17.30	0.97
49.65	2.46	17.53	0.99
52.06	6.12	18.38	1.03
52.29	3.62	18.46	1.04
52.96	5.44	18.70	1.05
53.06	7.13	18.73	1.05
53.57	7.69	18.91	1.06
53.65	4.83	18.94	1.07
53.97	1.83	19.05	1.07
54.29	7.10	19.16	1.08
55.08	13.71	19.44	1.09
55.71	0.93	19.66	1.11
57.36	10.90	20.25	1.14

Notes: Quartz SAR OSL age (following Murray and Wintle, 2000)
Sample analyzed using a double SAR protocol to remove feldspar signal
(following Olley et al. 2004)

USU LUMINESCENCE LABORATORY
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Lab procedures for sample processing and age analysis

All samples were opened and processed under dim amber safelight conditions within the lab. Sample processing follows standard procedures involving sieving, gravity separation and acid treatments with HCl and HF to isolate the quartz component of a narrow grain-size range, usually 90-150 μm. The purity of the samples is checked by measurement with infra-red stimulation to detect the presence of feldspar. Sample processing procedures follow those outlined in Aitken (1998) and described in Rittenour et al. (2003, 2005).

The USU Luminescence Lab follows the latest single-aliquot regenerative-dose (SAR) procedures for dating quartz sand (Murray and Wintle, 2000, 2003; Wintle and Murray, 2006). The SAR protocol includes tests for sensitivity correction and brackets the equivalent dose (De) the sample received during burial by irradiating the sample at five different doses (below, at, and above the De, plus a zero dose and a repeated dose to check for recuperation of the signal and sensitivity correction). The resultant data are fit with a saturating exponential curve from which the De is determined. The reported De is based on the mean and standard deviation from the measurement of at least 20 aliquots of sand mounted on a 2-mm diameter area of the measurement disks.

Dose-rate measurements were determined by chemical analysis of the U, Th, K and Rb content using ICP-MS and ICP-AES techniques. The contribution of cosmic radiation to the dose rate was calculated using sample depth, elevation, and latitude/longitude following Prescott and Hutton (1994). Dose rates are calculated based on water content, sediment chemistry, and cosmic contribution (Aitken, 1998).

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