OSL Geochronology Results for the Washington Dome, Santa Clara, and Kanab 7.5′ Quadrangles, Washington and Kane Counties, Utah

by

Utah Geological Survey

and

Utah State University Luminescence Laboratory

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INTRODUCTION

This open-file report makes available raw analytical data from laboratory procedures completed to determine the age of sediment collected during geologic investigations funded or partially funded by the Utah Geological Survey (UGS). The references listed in table 1 provide additional information such as sample location, geologic setting, and significance or interpretation of the samples in the context of the area where they were collected. This report was prepared by Utah State University Luminescence Laboratory under contract to the UGS. These data are highly technical in nature and proper interpretation requires considerable training in applicable geochronologic techniques.

The "WD" samples help constrain timing of fault movement on the Washington fault east of St. George in Washington County, southwest Utah.

The "SC" samples help to constrain the maximum age of the Santa Clara basalt flow in and near Snow Canyon State Park, Washington County, southwest Utah.

The "KB" samples help constrain the cyclic history of alluvial incision and aggradation and backfilling along Kanab Creek in Kane County, southern Utah.

The laboratory data and methods are available at:
http://geology.utah.gov/online/analytical_data.htm

Descriptions, explanations, and interpretations of the data are in the publications listed in the References section below.

Table 1. *Sample number and location.*

Sample #	USU #	7.5′ Quadrangle	UTM Northing	UTM Easting	Elevation (ft)
WD030107-1	USU-106	Washington Dome	4107383	278339	2690
WD030107-2	USU-107	Washington Dome	4107383	278339	2684
WD030107-3	USU-108	Washington Dome	4107383	278339	2696
WD030107-4	USU-109	Washington Dome	4107383	278339	2693
WD030107-5	USU-110	Washington Dome	4107383	278339	2692
SC030207-1	USU-111	Santa Clara	4114845	264079	2860
SC030207-2	USU-112	Santa Clara	4114788	264094	2860
SC030207-3	USU-113	Santa Clara	4114788	264094	2860
KB031007-1	USU-114	Kanab	4100628	363443	4848
KB031107-1	USU-115	Kanab	4103226	362917	4910

NAD 27, UTM Zone 12

DISCLAIMER

This open-file release is intended as a data repository for information gathered in support of various UGS projects. The data are presented as received from Utah State University Luminescence Laboratory and do not necessarily conform to UGS technical, editorial, or policy standards; this should be considered by an individual or group planning to take action based on the contents of this report. The Utah Department of Natural Resources, Utah Geological Survey, makes no warranty, expressed or implied, regarding the suitability of this product for a particular use. The Utah Department of Natural Resources, Utah Geological Survey, shall not be liable under any circumstance for any direct, indirect, special, incidental, or consequential damages with respect to claims by users of this product.

REFERENCES

The following publications cite, describe, discuss, and/or interpret the samples, analytical data, and geologic setting of the samples or sample sites listed in this report.

Biek, R.F., Rowley, P.D., Hayden, J.M., Hacker, D.B., Willis, G.C., Hintze, L.F., Anderson, R.E., and Brown, K.D., 2010, Geologic map of the St. George and east part of the Clover Mountains 30′ x 60′ quadrangles, Washington and Iron Counties, Utah: Utah Geological Survey Map 242DM, 2 plates, 101 p., scale 1:100,000, GIS data (printed map published in 2009 as Map 242).

Hayden, J.M., 2011, Geologic map of the Kanab 7.5′ quadrangle, Kane County, Utah, and Mohave and Coconino Counties, Arizona: Utah Geological Survey Map 248DM, 2 plates, scale 1:24,000.

Hayden, J.M., 2011, Geologic map of the White Hills quadrangle, Washington County, Utah: Utah Geological Survey Map 250DM, 2 plates, 11 p., scale 1:24,000.

Hayden, J.M., 2011, Geologic road and trail guides to Snow Canyon State Park, Utah, *in* Anderson, P.B., and Sprinkel, D.A., editors, Geologic road, trail, and lake guides to Utah's parks and monuments: Utah Geological Association and Bryce Canyon Natural History Association, Utah Geological Association Publication 29 (third edition), 29 p., CD ROM.

Lund, W.R., Knudsen, T.R., Vice, G.S., and Shaw, L., 2008, Geologic hazards and adverse construction conditions, St. George—Hurricane metropolitan area, Washington County, Utah: Utah Geological Survey Special Study 127, 105 p., DVD.

Knudsen, T.R., in press, Geology of the Fort Pearce and Washington Hollow sections of the Washington fault zone, Washington County, Utah and Mohave County, Arizona, *in* Lund, W.R., editor, Geologic mapping and paleoseismic investigations of the Washington fault zone, Washington County, Utah, and Mohave County, Arizona—Paleoseismology of Utah, Utah Geological Survey Special Study, 2 plates, DVD.

Nelson, M.S., and Rittenour, T.R., 2014, Middle to late Holocene chronostratigraphy of alluvial fill deposits along Kanab Creek in southern Utah, *in*, MacLean, J.S., Biek, R.F., and Huntoon, J.E., Geology of Utah's far south: Utah Geological Association Publication 43, p. 97-115, plates in appendix.

Simon, D.B., Black, D.K, Hanson, J.R., and Rowley, P.D., in press, Surface-fault-rupture-hazard investigation for a portion of the Southern Parkway (State Route 7) northern extension, Fort Pearce section, Washington fault zone, Washington County, Utah, *in* Lund, W.R., editor, Geologic mapping and paleoseismic investigations of the Washington fault zone, Washington County, Utah and Mohave County, Arizona—Paleoseismology of Utah, Utah Geological Survey Special Study, DVD.

Summa, M.C., 2009, Geologic mapping, alluvial stratigraphy, and optically stimulated luminescence dating of the Kanab Creek area, southern Utah: Logan, Utah State University, M.S. thesis, 170 p.

Summa-Nelson, M.C., and Rittenour, T.M., 2012, Application of OSL dating to middle to late Holocene arroyo sediments in Kanab Creek, southern Utah, USA: Quaternary Geochronology, v. 10, p. 167-174.

Willis, G.C., and Biek, R.F., 2001, Quaternary incision rates of the Colorado River and major tributaries in the Colorado Plateau, Utah, *in* Young, R.A., and Spamer, E.E., editors, Colorado River origin and evolution—proceedings of the symposium held at Grand Canyon National Park in June 2000: Grand Canyon Association Monograph 12, p. 119-123.

Willis, G.C., Biek, R.F., and Hayden, J.M., 2006, New age of the Santa Clara (Snow Canyon State Park) basalt flow: Utah Geological Survey, Survey Notes, v. 38, no. 3, p. 4-5.

Willis, G.C., and Hayden, J.M., 2015, Geologic map of the Santa Clara quadrangle, Washington County, Utah: Utah Geological Survey Map 271DM, 2 plates, scale 1:24,000.

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Project: **Utah Geological Survey**
Report Date: **26 February 2008**
Report by: Tammy Rittenour

Optically Stimulated Luminescence Age Information

Sample #	USU #	depth (m)	# disks	dose rate (Gy/ka)	De, Gy (SD)	OSL age (ka)	comments
WD030107-1	USU-106	3.0	**23**	1.08 ± 0.05	73.37 ± 14.43	**67.75 ± 4.56**	Washington fault, old wedge
WD030107-2	USU-107	5.0	**26**	1.04 ± 0.05	78.55 ± 16.51	**75.57 ± 5.13**	Washington fault, old wedge
WD030107-3	USU-108	0.5	**25**	1.49 ± 0.07	27.73 ± 4.85	**18.59 ± 1.16**	Washington fault, young wedge
WD030107-4	USU-109	1.25	**25**	1.37 ± 0.06	41.80 ± 9.42	**30.59 ± 2.10**	Washington fault, middle wedge
WD030107-5	USU-110	2.0	**21**	1.32 ± 0.06	40.67 ± 8.36	**30.81 ± 2.11**	Washington fault, middle wedge
SC030207-1	USU-111	2.0	**22**	1.04 ± 0.05	41.61 ± 5.93	**40.03 ± 2.50**	sand under Santa Clara flow
SC030207-2	USU-112	2.0	**24**	1.08 ± 0.05	43.77 ± 6.51	**40.39 ± 2.49**	sand under Santa Clara flow
SC030207-3	USU-113	2.1	**25**	1.29 ± 0.06	52.20 ± 12.94	**40.61 ± 2.93**	sand under Santa Clara flow
KB031007-1	USU-114	12.2	**23**	0.87 ± 0.04	9.81 ± 2.23	**11.24 ± 0.84**	alluvial fill in Kanab Creek
KB031107-1	USU-115	24.4	**23**	1.70 ± 0.08	14.60 ± 2.12	**8.58 ± 0.51**	alluvial fill in Kanab Creek

Dose Rate Information

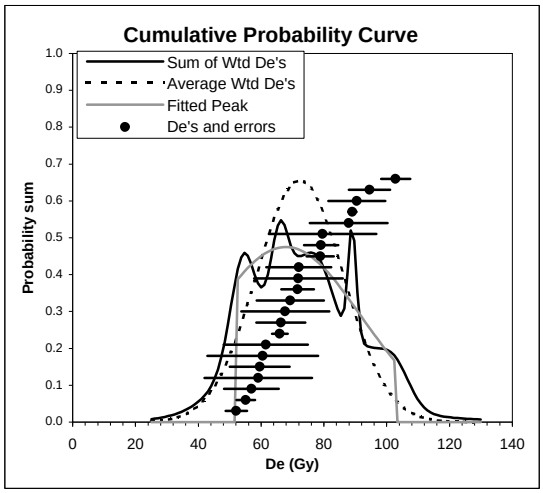
Sample #	USU #	grain size (μm)	H_2O%*	U (ppm)	Th (ppm)	K_20%	Rb_20 (ppm)	cosmic (Gy/ka)	Northing, Easting; elevation (ft)
WD030107-1	USU-106	90-150	0.5±3.0	0.6	2.1	0.65	26.6	0.15	4107383, 278339; 2690
WD030107-2	USU-107	90-150	0.6±3.0	0.6	1.9	0.66	24.2	0.11	4107383, 278339; 2684
WD030107-3	USU-108	90-150	1.7±3.0	0.8	3.1	0.89	34.7	0.22	4107383, 278339; 2696
WD030107-4	USU-109	90-150	1.1±3.0	0.7	2.3	0.86	31.5	0.2	4107383, 278339; 2693
WD030107-5	USU-110	90-150	0.9±3.0	0.7	2.2	0.84	30.4	0.17	4107383, 278339; 2692
SC030207-1	USU-111	90-150	0.5±3.0	0.5	1.9	0.62	23.6	0.17	4114845, 264079; 2860
SC030207-2	USU-112	90-150	0.6±3.0	0.6	2.2	0.62	24.6	0.17	4114788, 264094; 2860
SC030207-3	USU-113	90-150	1.3±3.0	0.7	2.8	0.77	33.1	0.17	4114788, 264094; 2860
KB031007-1	USU-114	90-150	0.2±3.0	0.5	1.6	0.59	21.5	0.05	4100628, 363443; 4848
KB031107-1	USU-115	90-150	1.1±3.0	1	2.8	1.27	43	0.02	4103226, 362917; 4910

* In-situ moisture content
Error on De is 1 standard deviation
Error on age includes random and systematic errors calculated in quadrature

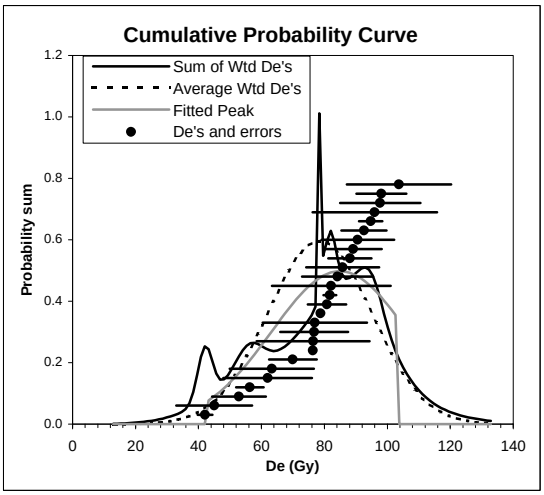
Age analysis using the single-aliquot regenerative-dose (SAR) procedure of Murray and Wintle (2000) on quartz sand using 2-mm aliquots.

Equivalent dose (De) distributions

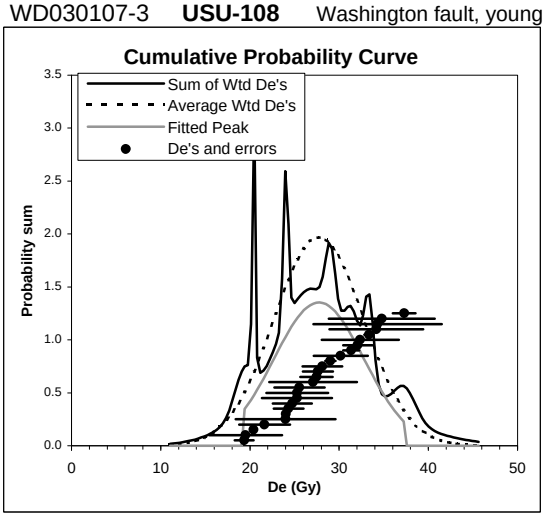
WD030107-1 **USU-106** Washington fault, old wedge



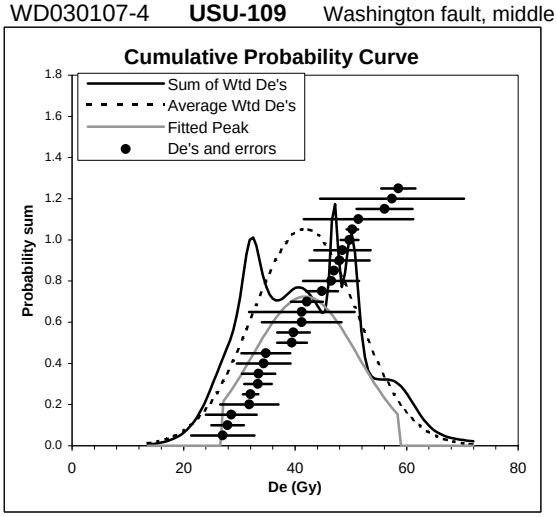
WD030107-2 **USU-107** Washington fault, old wedge



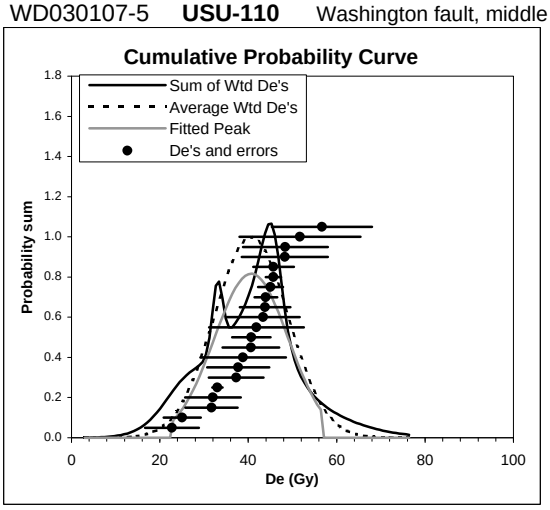
WD030107-3 **USU-108** Washington fault, young wedge



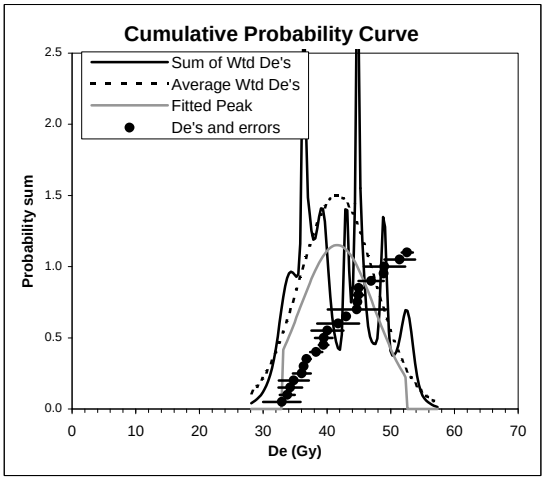
WD030107-4 **USU-109** Washington fault, middle wedge



WD030107-5 **USU-110** Washington fault, middle wedge

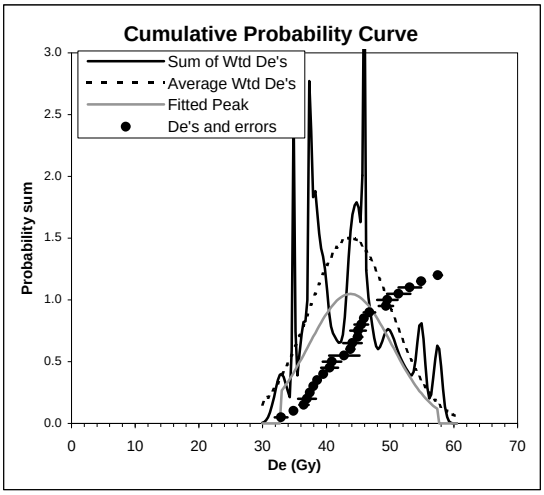


SC030207-1 **USU-111** sand under Santa Clara flow

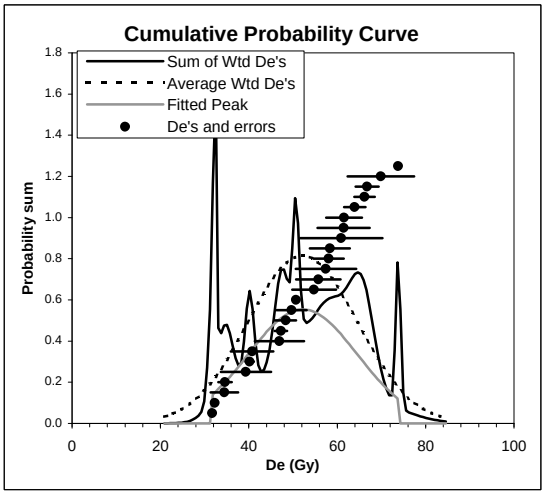


Equivalent dose (De) distributions (cont.)

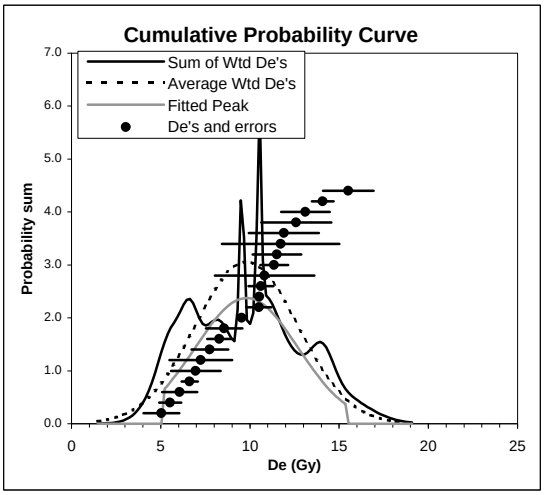
SC030207-2 **USU-112** sand under Santa Clara flow



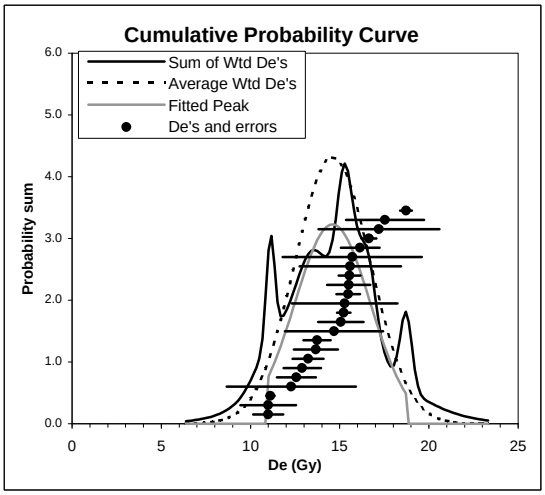
SC030207-3 **USU-113** sand under Santa Clara flow



KB031007-1 **USU-114** alluvial fill in Kanab Creek



KB031107-1 **USU-115** alluvial fill in Kanab Creek



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).

Aitken, M.J., 1998. An Introduction to Optical Dating. Oxford Science Publications, 267pp.

Prescott, J. R., Hutton, J.T., 1994. Cosmic ray contributions to dose rates for luminescence and ESR dating: Radiation Measurements 23, 497-500.

Murray, A.S., Wintle, A.G., 2000. Luminescence dating of quartz using an improved single aliquot regenerative-dose protocol. Radiation Measurements 32, 57-73.

Murray, A.S., Wintle, A.G., 2003. The single aliquot regenerative dose protocol: potential for improvements in reliability. Radiation Measurements 37, 377-381.

Rittenour, T.M., Goble, R.J., Blum, M.D., 2003, An Optical Age Chronology of Fluvial Deposits in the Northern Lower Mississippi Valley: Quaternary Science Reviews, v. 22, p. 1105-1110.

Rittenour, T.M., Goble, R.J., Blum, M.D., 2005, Development of an OSL chronology for late Pleistocene channel belts in the lower Mississippi valley: Quaternary Science Reviews, v.24, p.2539-2554.

Wintle, A.G. Murray, A.S., 2006, A review of quartz optically stimulated luminescence characteristics and their relevance in single-aliquot regenerative protocols: Radiation Measurements, v. 41, p. 369-391.