

**Table 1.** Petrology of the samples used in this study. See Fig. 3 for additional location information.

Location	Latitude (degrees)	Longitude (degrees)	Number of grains measured	Mean grain size (Φ)	Mode (Φ)	d50 (Φ)	Std Dev (Φ)	Sorting	Rounding score for thin section (0 to 6)	Rounding score for K-feldspar (0 to 6)	Counted (c) or estimated (e)?	Quartz	Chert	K-feldspar	Plagioclase	Kaolinite	Mica	Other	Brown tourmaline(?) (usually well-rounded)	Zircons (usually well-rounded)	Black opaque minerals (usually well-rounded)	Dolomite (clasts, cement, rhombs, ooids)
American Sandstone Ridge																						
ASR-06	35.04072	112.28378																				y
ASR-07	35.04072	112.28378	611	3.15	3.00, 3.25	3.08	0.63	moderately sorted	3.5	3.5	e	79	15	6	t	t	t	t	t	t	t	n
ASR-09	35.04072	112.28378	533	3.66	4.00	3.70	0.71	poorly sorted	3.0	2.5	e	68	17	15	0	0	t	t	t	t	t	n
ASR-10	35.04072	112.28378	522	2.66	2.75	2.69	0.56	moderately sorted	3.5	3.5	e	70	18	12	0	0	t	t	0	t	t	n
ASR-11	35.04072	112.28378	676	3.25	3.00	3.15	0.75	poorly sorted	3.0	3.5	e	74	17	9	0	0	t	t	t	t	t	n
ASR-12	35.04072	112.28378	558	3.65	3.75	3.65	0.67	moderately sorted	2.5	2.5	c	63	17	18	0	1	t	1	t	t	t	n
ASR-13	35.04072	112.28378	546	2.95	3.00	2.93	0.51	well sorted	3.5	2.5	e	68	17	15	0	0	t	t	t	t	t	n
ASR-14	35.04072	112.28378	587	3.04	3.00	2.98	0.58	moderately sorted	3.0	2.5	e	68	14	18	0	0	t	t	t	0	t	n
ASR-15	35.04072	112.28378	501	3.08	3.00	2.97	0.67	moderately sorted	3.0	3.0	e	79	15	6	0	0	t	t	t	t	t	n
ASR Overall			2400	3.18	3.00	3.10	0.71	poorly sorted	3.1	2.9		71	16	12								
Cave Spring Campground																						
CSC-01	34.99660	111.73805	487	2.88	3.00	2.87	0.51	well sorted	2.5	na	c	74	17	0	0	6	t	t	t	t	t	n
CSC-02	34.99660	111.73805	406	3.19	3.00	3.12	0.44	very well sorted	3.5	na	e	75	16	0	0	6	0	t	t	t	0	n
CSC-Overall			600	3.04	3.00	2.95	0.50	well sorted	3.0	na		75	17	0								
Cottonwood Wash																						
CW-01	34.36372	110.33038	448	3.23	3.25	3.21	0.48	well sorted	3.5	2.5	e	63	15	10	t	2	0	t	t	0	t	n
CW-02	34.36372	110.33038	585	2.98	3.00	2.99	0.63	moderately sorted	2.5	2.5	c	74	17	6	t	2	0	t	t	t	t	n
CW-Overall			600	3.10	3.25	3.12	0.56	moderately sorted	3.0	2.5		69	16	8								
Chino Point West																						
CPW-05	35.35258	112.95542	488	3.22	3.00	3.14	0.56	moderately sorted	3.0	3.5	e	89	5	5	1	0	0	t	t	0	t	n
CPW-08	35.35258	112.95542	538	3.42	3.00	3.20	0.90	very poorly sorted	3.5	3.5	e	85	9	5	1	0	t	t	t	0	t	n
CPW-10	35.35258	112.95542	435	3.13	3.25	3.05	0.54	well sorted	3.5	3.0	e	85	12	3	t	0	t	t	0	t	t	n
CPW-13	35.35258	112.95542	410	3.07	3.00	2.98	0.57	moderately sorted	3.5	2.5	e	90	10	t	t	0	t	t	t	0	t	n
CPW-16	35.35258	112.95542	424	3.17	3.25	3.13	0.58	moderately sorted	3.5	4.5	c	91	4	2	4	t	t	t	t	t	t	n
CPW-19	35.35258	112.95542	425	3.18	3.25	3.14	0.49	well sorted	3.5	3.5	e	92	8	t	0	t	t	t	t	t	t	n
CPW-23	35.35258	112.95542	420	3.32	3.50	3.27	0.83	poorly sorted	3.5	1.5	e	91	8	1	0	t	t	t	t	t	t	n
CPW-25	35.35258	112.95542	465	2.92	3.00	2.87	0.65	moderately sorted	4.0	3.0	e	85	15	t	t	t	t	t	t	0	t	n
CPW-29	35.35258	112.95542	438	3.19	3.25	3.18	0.46	well sorted	3.5	na	e	78	22	0	t	t	t	t	t	0	t	n
CPW-32	35.35258	112.95542	422	3.17	3.25	3.12	0.49	well sorted	3.0	2.5	e	73	18	8	0	0	t	t	t	t	t	n

Location	Latitude (degrees)	Longitude (degrees)	Number of grains measured	Mean grain size (Φ)	Mode (Φ)	d50 (Φ)	Std Dev (Φ)	Sorting	Rounding score for thin section (0 to 6)	Rounding score for K-feldspar (0 to 6)	Counted (c) or estimated (e)?	Quartz	Chert	K-feldspar	Plagioclase	Kaolinite	Mica	Other	Brown tourmaline(?)- (usually well-rounded)	Zircons (usually well-rounded)	Black opaque minerals (usually well-rounded)	Dolomite (clasts, cement, rhombs, ooids)
CPW-35	35.35258	112.95542	400	3.52	3.50	3.39	0.66	moderately sorted	3.0	3.0	c	73	18	8	1	0	t	t	t	t	t	n
CPW-37	35.35258	112.95542	412	3.14	3.25	3.12	0.50	well sorted	3.5	3.0	e	75	18	7	0	0	t	t	t	0	t	n
CPW-39	35.35258	112.95542	458	3.22	3.25	3.18	0.52	well sorted	3.5	3.0	e	74	18	8	0	0	t	t	0	t	t	n
CPW-41	35.35258	112.95542	421	3.17	3.25	3.11	0.50	well sorted	3.5	3.0	e	72	18	10	0	0	t	0	t	0	0	n
CPW-Overall			4200	3.20	3.25	3.12	0.61	moderately sorted	3.4			82	13	5								
Forestdale																						
FD-05	34.15167	110.10280	510	2.91	2.75	2.78	0.66	moderately sorted	3.5	3.0	e	81	7	2	0	t	t	t	0	0	t	n
FD-06	34.15167	110.10280	557	2.84	2.75	2.76	0.52	well sorted	4.0	3.5	e	84	4	4	0	8	0	t	0	0	0	n
FD-07	34.15814	110.10100	761	2.76	2.50	2.73	0.70	poorly sorted	3.5	na	e	88	6	0	0	6	t	t	t	t	t	n
FD-08	34.15814	110.10100	487	2.59	2.75	2.53	0.77	poorly sorted	3.5	na	e	88	10	0	0	2	0	t	t	t	t	n
FD-09	34.16282	110.09975	411	2.86	3.00	2.96	0.68	moderately sorted	3.0	na	c	83	7	0	1	8	0	0	t	t	t	n
FD-10	34.16282	110.09975	469	2.67	2.75	2.68	0.61	moderately sorted	3.0	na	e	90	t	0	0	10	0	0	0	t	0	n
FD-11	34.17132	110.09808	695	2.77	3.00	2.79	0.70	poorly sorted	3.0	na	e	88	5	0	0	7	0	0	0	0	0	n
FD-12	34.17132	110.09808	776	2.86	3.25	2.93	0.71	poorly sorted	2.5	na	e	85	7	0	0	8	0	0	0	t	0	n
FD-13	34.17500	110.09743	565	2.43	3.00	2.61	0.96	very poorly sorted	3.5	na	e	88	4	0	0	8	0	t	0	t	t	n
FD-14	34.18333	110.09342	550	2.91	3.00	2.87	0.50	well sorted	3.5	na	e	85	5	0	0	10	0	t	t	t	t	n
FD-Overall			3000	2.76	3.00	2.78	0.71	poorly sorted	3.3			86	6	1								
Hermit Trail																						
HMT-01	36.05527	112.22035	515	2.99	3.00	2.94	0.65	moderately sorted	3.0	3.5	e	73	25	2	0	t	0	0	t	t	t	n
HMT-02	36.05518	112.22033	392	3.16	3.25	3.12	0.52	well sorted	2.5	3.0	c	67	25	3	0	5	t	0	t	t	0	n
HMT-03	36.05523	112.22027	679	3.00	3.00	2.94	0.53	well sorted	3.0	3.5	e	72	22	3	0	3	t	0	t	0	t	n
HMT-04	36.05522	112.22007	450	3.29	3.25	3.23	0.66	moderately sorted	2.0	3.5	e	74	18	4	0	4	t	0	t	t	t	n
HMT-05	36.05510	112.22012	581	3.78	4.00	3.81	0.75	poorly sorted	2.5	3.0	e	73	18	4	0	5	<1	0	t	t	t	y
HMT-06	36.05505	112.21993	503	2.78	2.75	2.73	0.49	well sorted	2.5	3.0	e	82	12	3	0	3	0	0	t	0	0	t
HMT-07	36.05550	112.21910	559	2.92	3.00	2.87	0.54	well sorted	2.5	3.5	e	77	15	3	0	5	t	0	t	t	t	n
HMT-08	36.05595	112.21848	456	3.26	3.00	3.22	0.62	moderately sorted	3.0	3.5	e	72	15	6	0	7	t	0	t	t	t	?
HMT-09	36.05633	112.21833	418	3.10	3.00	3.04	0.52	well sorted	2.5	3.5	e	66	25	4	0	5	t	?	t	t	t	?
HMT-10	36.05620	112.21803	386	3.12	3.00	3.06	0.72	poorly sorted	3.0	3.5	e	77	15	5	0	3	t	0	t	t	t	n
HMT-Overall			3000	3.13	3.00	3.04	0.66	moderately sorted	2.7	3.4		73	19	4	0	4						
Holbrook																						
HOL-01	34.83447	110.14444	549	2.97	3.00	2.91	0.62	moderately sorted	3.5	2.5	e	86	9	5	0	t	t	t	t	t	t	n
HOL-02	34.76949	110.12708	604	2.87	2.75	2.81	0.58	moderately sorted	2.5	2.5	c	86	9	5	0	t	t	t	0	t	t	n
HOL-03	34.63827	110.09557	596	2.61	2.50	2.52	0.79	poorly sorted	3.0	2.5	e	87	10	3	0	t	0	t	t	0	t	n
HOL-04	34.59130	110.08624	530	2.55	2.75	2.51	0.69	moderately sorted	3.0	na	e	89	10	0	t	1	t	0	0	0	0	n
HOL-05	34.45013	110.07483	558	2.76	3.25	2.92	0.76	poorly sorted	3.5	na	e	88	10	0	t	2	0	0	0	0	0	n

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HOL-Overall			1500	2.76	2.75	2.77	0.72	poorly sorted	3.1	2.5		87	10	3								
Jumpup Spring																						
JUS-05	36.58533	112.54714	743	3.99	4.00, 4.25	4.00	0.94	very poorly sorted	2.0	2.0	e	85	8	7	0	t	t	t	0	0	t	y
JUS-06	36.58533	112.54714	398	3.36	3.50	3.31	0.77	poorly sorted	3.0	2.5	e	85	5	10	0	t	t	t	t	t	t	n
JUS-07	36.58533	112.54714	482	3.20	3.25	3.18	0.83	poorly sorted	2.5	3.0	c	85	8	6	0	t	t	0	0	0	0	y
JUS-08	36.58533	112.54714	564	3.22	3.25	3.20	0.81	poorly sorted	2.5	3.0	e	80	10	10	0	t	t	t	0	t	t	n
JUS-09	36.58533	112.54714	391	3.37	3.00	3.28	1.13	very poorly sorted	2.5	2.0	e	93	1	6	0	0	t	0	0	0	0	y
JUS-Overall			1500	3.42	3.25	3.37	0.97	very poorly sorted	2.5	2.5		86	6	8								
New Hance Trail																						
NH-11	35.99735	111.93817	444	3.19	3.00	3.12	0.61	moderately sorted	3.0	2.5	e	76	20	3	0	1	t	0	0	t	t	?
NH-12	35.99735	111.93810	485	3.37	3.75	3.37	0.71	poorly sorted	2.5	3.0	e	65	28	2	0	5	t	0	t	t	t	?
NH-13	35.99733	111.93810	372	3.03	2.75	2.91	0.57	moderately sorted	3.0	3.5	e	70	28	2	0	t	t	0	0	t	t	n
NH-14	35.99587	111.93867	469	3.35	3.00	3.29	0.70	poorly sorted	2.5	3.5	e	61	28	1	0	10	t	0	t	t	t	n
NH-15	35.99562	111.93835	445	3.33	3.75	3.27	0.71	poorly sorted	3.0	3.5	e	65	25	2	0	8	t	0	t	t	t	n
NH-16	35.99568	111.93835	369	3.19	3.00	3.06	0.74	poorly sorted	2.5	3.5	e	66	28	1	0	5	t	0	t	t	t	n
NH-17	35.99542	111.93832	518	3.49	4.00	3.50	0.74	poorly sorted	3.0	4.0	e	66	28	1	0	5	t	0	t	t	t	?
NH-18	35.99598	111.93777	423	3.22	3.00	3.15	0.63	moderately sorted	2.5	3.0	c	65	28	1	0	5	t	0	t	t	t	?
NH-19	35.99595	111.93745	389	3.06	3.00	2.97	0.63	moderately sorted	3.0	3.5	e	65	28	2	0	4	0	1	t	t	t	?
NH-20	35.99605	111.93737	446	3.18	3.25	3.12	0.59	moderately sorted	2.5	3.5	e	64	28	2	0	5	<1	1	t	t	t	?
NHT-07	35.99795	111.94110	685	4.01	3.50	4.00	0.86	poorly sorted	2.5	na	e	95	5	0	t	t	t	t	t	t	t	y
NHT-08	35.99795	111.94110	612	3.92	4.00	3.88	0.79	poorly sorted	2.0	na	c	88	13	0	t	t	t	t	t	t	t	y
NHT-Overall			3600	3.37	3.00	3.28	0.76	poorly sorted	2.7	3.4		70	24	1								
Pine Creek Trail																						
PCT-02	34.44139	111.42278	620	2.97	3.00	2.93	0.59	moderately sorted	4.5	3.5	e	84	11	3	t	2	t	t	0	t	t	n
PCT-03	34.44139	111.42278	476	3.39	3.50	3.62	0.63	moderately sorted	2.5	2.5	e	81	11	6	0	2	t	t	t	t	t	n
PCT-04	34.44139	111.42278	552	3.12	3.25	3.10	0.69	moderately sorted	4.5	2.5	c	83	11	6	0	t	t	t	t	t	t	n
PCT-05	34.44139	111.42278	448	2.91	2.75	2.87	0.73	poorly sorted	4.0	3.5	e	85	10	3	t	2	t	t	0	t	t	n
PCT-06	34.44139	111.42278	464	3.50	3.75	3.48	0.64	moderately sorted	2.5	3.0	e	83	7	8	0	2	t	t	t	t	t	n
PCT-08	34.44139	111.42278	452	3.29	3.25	3.25	0.57	moderately sorted	3.0	3.5	e	83	7	8	0	2	t	t	t	t	t	n
PCT-09	34.44139	111.42278	655	3.03	3.25	3.02	0.56	moderately sorted	3.0	3.5	e	86	11	3	0	t	0	t	t	t	t	n
PCT-11	34.44139	111.42278	391	3.03	3.25	3.03	0.49	well sorted	2.5	3.5	e	84	11	3	0	2	0	t	t	t	t	n
PCT-12	34.44139	111.42278	327	2.88	2.75	2.87	0.50	well sorted	3.0	3.5	e	85	12	3	0	t	t	t	t	t	t	n
PCT-13	34.44139	111.42278	661	2.90	3.00	2.87	0.44	very well sorted	3.5	na	e	85	12	t	0	3	0	t	t	t	t	n

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PCT-14	34.44139	111.42278	498	2.80	3.00	2.80	0.77	poorly sorted	2.5	na	e	82	15	0	0	3	t	t	t	t	t	n
PCT-15	34.44139	111.42278	500	2.60	2.75	2.57	0.79	poorly sorted	3.5	na	e	79	18	0	0	3	t	t	0	t	t	n
PCT-16	34.44139	111.42278	464	2.51	2.75	2.51	0.64	moderately sorted	3.5	na	e	87	10	0	0	3	0	t	0	0	t	n
PCT-17	34.44139	111.42278	474	2.82	3.00	2.81	0.60	moderately sorted	3.0	na	c	79	18	t	0	3	t	t	0	0	t	n
PCT-18	34.44139	111.42278	469	2.77	2.75	2.80	0.85	poorly sorted	3.5	na	e	81	16	0	0	3	t	t	t	t	t	n
PCT-19	34.44139	111.42278	411	2.84	2.75	2.80	0.70	poorly sorted	3.0	na	e	81	15	0	t	4	0	t	t	t	t	n
PCT-Overall			4800	2.96	3.00	2.95	0.69	moderately sorted	3.3	3.2		83	12	3								
South Kaibab Trail																						
SK-03	36.06147	112.08582	546	3.46	2.75	3.08	1.08	very poorly sorted	2.5	na	e	92	8	0	t	t	t	t	t	t	t	y
SK-04	36.06147	112.08582	409	3.31	3.25	3.18	0.71	poorly sorted	3.0	na	c	79	19	0	2	t	t	0	t	t	t	y
SK-Overall			600	3.41	3.00	3.19	0.91	very poorly sorted	2.8			85	14	0								
Trail Canyon																						
TC-05	36.28803	113.33016	468	3.45	3.75	3.47	0.65	moderately sorted	3.0	3.0	e	79	11	10	t	t	t	t	0	0	t	n
TC-06	36.28803	113.33016	431	3.35	3.25	3.28	0.65	moderately sorted	2.5	3.0	c	78	11	8	2	1	t	t	0	t	t	n
TC-07 (core)	36.28803	113.33016	634	3.38	3.50	3.47	0.86	poorly sorted	2.5	2.5	e	94	0	6	0	t	t	t	0	0	t	y
TC-07 (oolith)	36.28803	113.33016	568	2.66	2.75	2.73	0.73	poorly sorted														
TC-08 (core)	36.28803	113.33016	542	3.73	3.75	3.62	0.64	moderately sorted	1.5	1.5	e	88	0	12	t	t	0	t	0	t	t	y
TC-Overall (core)			1200	3.47	3.50	3.47	0.71	poorly sorted	2.4	2.5		85	6	9								
Warm Springs Canyon																						
WSC-29	36.67507	112.34345	427	3.21	3.25	3.23	0.56	moderately sorted	3.0	3.0	e	82	5	10	t	3	t	t	t	t	t	y
WSC-10	36.67507	112.34345	521	3.27	3.00	3.24	0.88	poorly sorted	3.0	3.0	e	80	10	8	0	2	t	t	0	0	t	y
WSC-12	36.67507	112.34345	586	3.60	3.50	3.56	0.60	moderately sorted	2.5	3.0	c	74	14	9	0	4	t	t	t	t	t	y
WSC-13	36.67507	112.34345	408	3.54	3.00	3.27	0.88	poorly sorted	2.5	3.5	e	74	14	8	0	4	t	t	t	t	t	y
WSC-14	36.67507	112.34345	492	3.31	3.25	3.23	0.58	moderately sorted	3.0	3.0	e	79	8	9	0	4	t	t	t	t	t	n
WSC-Overall			1500	3.37	3.25	3.31	0.88	poorly sorted	2.8	3.1		78	10	9								
Whitmore Canyon																						
WC-03	36.26957	113.22733	658	3.73	3.50	3.68	0.64	moderately sorted	3.0	2.5	e	79	8	8	0	5	t	t	t	t	t	y
WC-04	36.26957	113.22733	482	2.46	2.25	2.25	1.14	very poorly sorted	3.5	3.0	e	95	4	t	0	1	0	t	0	0	t	n
WC-05	36.26957	113.22733	467	3.26	3.25	3.21	0.54	well sorted	2.0	3.0	c	74	17	6	0	2	0	t	t	t	t	n
WC-06	36.26957	113.22733	501	3.67	3.50	3.56	0.86	poorly sorted	2.0	3.0	e	85	6	6	0	3	t	t	t	0	t	y
WC-07	36.26957	113.22733	393	2.77	2.75	2.75	0.65	moderately sorted	3.0	3.5	e	88	8	2	t	2	0	t	t	t	t	n
WC-08	36.26957	113.22733																				y
WC-Overall			1500	3.18	3.50	3.19	0.94	very poorly sorted	2.7	3.0		84	9	6								