

Sample	Rock	Th (ppm)	U (ppm)	K (%)	water factor	s-factor	internal K (%)	grain size (mm)	Total DR beta (Gy/a)	Total DR Gamma (Gy/a)	DR cosm (Gy/a)	DR total (Gy/a)
JV-10	Rock	10.44 ± 0.97	2.62 ± 0.17	2.05 ± 0.14	0.13 ± 0.03	0.234 ± 0.010	6.5 ± 1.5	1.67 ± 1.25	3.72 ± 1.04	0.702 ± 0.032	0.205 ± 0.010	4.63 ± 1.04
	Surround. Sed.	10.78 ± 1.03	2.63 ± 0.17	1.89 ± 0.11	0.13 ± 0.03	0.415 ± 0.020	7.0 ± 1.1	1.04 ± 0.63	3.00 ± 0.65	0.756 ± 0.033	0.204 ± 0.010	3.96 ± 0.65
JV-13	Rock	7.44 ± 0.65	1.95 ± 0.12	1.30 ± 0.10	0.13 ± 0.03	0.328 ± 0.008	12.0 ± 0.1	0.58 ± 0.33	3.40 ± 0.72	0.800 ± 0.036	0.205 ± 0.010	4.40 ± 0.72
	Surround. Sed.	10.83 ± 1.03	2.60 ± 0.17	2.02 ± 0.11	0.13 ± 0.03	0.348 ± 0.012	12.0 ± 0.1	0.50 ± 0.20	4.29 ± 0.53	0.988 ± 0.041	0.205 ± 0.010	5.49 ± 0.53
JV-14	Rock	7.94 ± 0.69	1.84 ± 0.11	1.34 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	12.34 ± 1.17	3.02 ± 0.20	2.28 ± 0.12	0.13 ± 0.03	0.348 ± 0.012	12.0 ± 0.1	0.50 ± 0.20	4.29 ± 0.53	0.988 ± 0.041	0.205 ± 0.010	5.49 ± 0.53
JV-15	Rock	17.58 ± 1.50	3.84 ± 0.23	2.92 ± 0.22	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	12.52 ± 1.19	2.78 ± 0.18	2.36 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-16	Rock	14.13 ± 1.37	3.89 ± 0.25	3.66 ± 0.19	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed. A	10.35 ± 0.96	2.36 ± 0.15	2.00 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed. B	13.02 ± 1.26	3.60 ± 0.23	3.72 ± 0.20	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-17	Rock	11.29 ± 0.94	2.15 ± 0.13	4.05 ± 0.32	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.90 ± 1.05	2.63 ± 0.17	2.23 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-20	Rock	11.75 ± 1.03	2.93 ± 0.18	2.36 ± 0.17	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	11.30 ± 1.09	2.74 ± 0.18	2.26 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-22	Rock	12.52 ± 0.98	3.09 ± 0.17	3.33 ± 0.19	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	12.18 ± 1.18	2.98 ± 0.19	2.26 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-23	Rock	10.44 ± 0.88	1.87 ± 0.12	2.32 ± 0.18	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	11.76 ± 1.13	2.74 ± 0.18	2.26 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-26	Rock	12.54 ± 1.15	1.98 ± 0.13	2.79 ± 0.19	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	12.20 ± 1.18	2.91 ± 0.19	2.37 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-27	Rock	14.28 ± 1.40	2.25 ± 0.15	3.22 ± 0.19	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.71 ± 1.22	2.39 ± 0.15	2.14 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-30	Rock	3.09 ± 0.26	0.47 ± 0.03	1.26 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	9.64 ± 0.93	2.07 ± 0.14	1.83 ± 0.10	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-32	Rock	15.68 ± 1.43	1.37 ± 0.10	3.84 ± 0.27	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.54 ± 1.02	1.93 ± 0.13	2.18 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
JV-34	Rock	13.77 ± 1.27	3.71 ± 0.27	1.85 ± 0.13	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.82 ± 1.05	2.57 ± 0.17	2.06 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
SOSL JV-07	Rock	10.46 ± 0.89	2.46 ± 0.16	2.16 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.16 ± 0.85	2.29 ± 0.15	2.24 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
SOSL JV-09	Rock	10.75 ± 0.91	2.88 ± 0.21	2.18 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.95 ± 0.93	2.64 ± 0.19	2.14 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
SOSL-101	Rock	11.40 ± 0.96	2.58 ± 0.19	2.21 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.85 ± 0.92	2.83 ± 0.20	2.30 ± 0.12	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
SOSL-102	Rock	10.90 ± 0.92	2.46 ± 0.18	2.14 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83
	Surround. Sed.	10.90 ± 0.92	2.46 ± 0.18	2.14 ± 0.11	0.13 ± 0.03	0.592 ± 0.013	13.3 ± 0.1	1.36 ± 0.57	6.56 ± 0.83	1.144 ± 0.041	0.202 ± 0.010	7.91 ± 0.83

All samples labelled "JV-X" are rock samples. Samples labelled with SOSL-X are sediment samples.
s-factor: The s-factor is used to correct the gamma dose rate for the limited size of the rock (size of rock relative to a 2π half layer). See Simms et al. (2011) for details.
Internal K and grain size: Internal K of the separates (Na-fsp, K-fsp, and / or mixed fsp) was measured with EPMA. To calculate internal beta dose rates for rocks the actual grains sizes prior to crushing were used as listed. For sediments the grain size after sifting was used.
Total DR beta: Total beta dose rate to the grains. The value includes all internal and external contributions.
Total DR Gamma: Total gamma dose rate to the grains. For rocks this includes the contribution from the rock itself, corrected for its size, and the surrounding sediment.

Table S1. Characteristics of the optically stimulated luminescence samples.

Table S2. Optically stimulated luminescence measurements.

sample	rock type	mineral	filter combi	grain size (µm)	n measured	n used	PH (°C)	Dose (Gy)	overdisp (%)	g (%/decade)	tc	DR total (Gy/a)	Age unbleached (ka)	Age (ka)	Beach Height (m)
JV-10	fractured hornblende granodiorite	mixed fsp	blue	63-250	29	8	170	11.22 ± 3.06	61	4.07 ± 2.6	4.5 h	4.63 ± 1.04	2.423072 ± 0.86	3.3 ± 1.3	4.3
JV-13	Biotite-hornblende Tonalite	mixed fsp	blue	63-500	46	37	160	8.83 ± 0.75	48	3.084 ± 0.11	5h	3.96 ± 0.65	2.23207 ± 0.41	2.77 ± 0.55	10.7
JV-14	Biotite hornblende Tonalite	mixed fsp	blue	63-500	43	24	160	0.85 ± 0.067	33	4.69 ± 0.43	4h	4.40 ± 0.72	0.193032 ± 0.04	0.257 ± 0.066	12.2
JV-15	biotite hornblende granite	K-fsp	blue	63-500	40	32	170	1.52 ± 0.13	40	no fading		5.49 ± 0.53	0.270574 ± 0.04	0.277 ± 0.036	11.6
JV-16	Hornblende tonalite	K-fsp	blue	63-212	25	25	160	6.35 ± 0.26	0	2.29 ± 0.16	4.5h	7.91 ± 0.83	0.803027 ± 0.09	0.92 ± 0.12	7.7
JV-17	Hornblende Quartz monzonite	K-fsp	yellow	63-250	30	19	180	3.00 ± 0.15	0	no fading		4.54 ± 0.45	0.660793 ± 0.07	0.661 ± 0.074	7.3
JV-20	Hornblende Tonalite	mixed fsp	blue	63-250	28	13	140	0.195 ± 0.022	31	7.5 ± 3.53	4.5h	2.22 ± 0.37	0.087912 ± 0.02	0.141 ± 0.035	5.3
JV-22	Hornblende Granite	K-fsp	blue	63-250	53	40	140	0.083 ± 0.004	16	no fading		6.80 ± 0.76	0.012256 ± 0.001	0.012 ± 0.001	6.2
JV-23	Biotite hornblende tonalite	Na-fsp	IR/blue	63-500	21	19	180	0.059 ± 0.004	12	no fading		3.71 ± 0.39	0.015836 ± 0.002	0.016 ± 0.002	6.1
JV-26	Biotite hornblende tonalite	Na-fsp	yellow	63-500	16	14	160	1.04 ± 0.068	21	2.42 ± 0.45	4.5h	5.53 ± 0.60	0.714747 ± 0.08	0.831 ± 0.12	6.1
JV-27	Hornblende granite	K-fsp	blue	63-250	17	17	180	21.04 ± 0.84	0	2.24 ± 0.16	4.5h	7.63 ± 0.68	2.758274 ± 0.27	3.21 ± 0.36	7.7
JV-30	Tonalite	Na-fsp	yellow	63-250	14	14	160	11.04 ± 0.42	0	3.46 ± 0.46	3h	5.37 ± 0.60	2.055703 ± 0.24	2.65 ± 0.42	6.1
JV-32	Hornblende Granite	mixed fsp	blue	63-500	34	30	160	245 ± 16	30	1.39 ± 0.38	4h	7.58 ± 0.74	N/A	27.2 ± 3.2	7.7
JV-34	Sandstone?	mixed fsp	blue	63-500	33	29	180	32.2 ± 1.6	20	2.01 ± 0.13	4.5h	7.26 ± 0.70	4.438474 ± 0.48	5.11 ± 0.61	7.7
SOSL JV-07		mixed fsp	blue	90-212	58	38	160	171 ± 24	70	6.02 ± 0.91	4h	3.38 ± 0.28	N/A	68 ± 17	10.7
SOSL JV-09		K-fsp	blue	63-212	41	25	180	9.57 ± 0.65	37	6.38 ± 0.46	4h	3.09 ± 0.15	3.098681 ± 0.26	5.38 ± 0.78	4.3
		K-fsp	yellow	63-212	21	15	180	8.00 ± 0.34	7	4.02 ± 0.26	4.5 h	3.47 ± 0.31	2.304032 ± 0.23	3.09 ± 0.38	
		Na-fsp	blue	63-212	40	19	170	6.84 ± 0.55	22	5.11 ± 0.94	4.5 h	3.16 ± 0.16	2.165611 ± 0.21	3.21 ± 0.47	4.3
		Na-fsp	yellow	63-212	31	21	160	6.76 ± 0.35	18	2.81 ± 0.15	3h	3.16 ± 0.16	2.140282 ± 0.15	3.21 ± 0.62	
SOSL-101		mixed fsp	blue	90-212	40	31	160	22.7 ± 1.5	31	6.81 ± 0.76	4h	3.40 ± 0.15	6.667992 ± 0.54	2.61 ± 0.3	12.2
SOSL-102		mixed fsp	blue	90-212	33	29	160	31.2 ± 2.2	32	4.04 ± 0.24	4h	3.53 ± 0.19	8.856699 ± 0.79	12.8 ± 2.5	12.2
SOSL-104		mixed fsp	blue	90-212	40	33	180	57.3 ± 3.6	29	4.83 ± 0.73	4h	3.46 ± 0.17	16.57337 ± 1.32	25.6 ± 4.3	11.5
SOSL-106		K-fsp	blue	90-212	33	26	180	51.2 ± 3.1	25	5.88 ± 0.53	12h	3.69 ± 0.20	13.88661 ± 1.12	23.1 ± 3.4	4.3
SOSL-107		mixed fsp	blue	90-212	47	41	160	19.1 ± 1.1	30	4.24 ± 0.04	12h	3.39 ± 0.17	5.614501 ± 0.44	7.66 ± 0.88	4.3

All samples labeled "JV-x" are rock samples. Samples labelled with SOSL-x are sediment samples.
 minerals: For samples with sufficient materials, feldspars were separated into K-feldspar (<2.58) and Na-feldspar (>2.58). For all other samples the fraction <2.62 was measured as "mixed" feldspars.
 filter combi: in general the brightest signal was used for dating. For most mixed feldspars and K-feldspars this was the blue signal, while Na-feldspars were brighter in yellow. There are some exceptions as listed.
 grain size: the grain size obtained after sifting of sediments or after crushing and sifting of rock sizes
 n measured and n used: the number of aliquots that were measured for a sample and the number of resulting reliable aliquots that were used for dose calculation
 PH: preheat temperature resulting from plateau and dose recovery tests
 overdisp: the overdispersion of the dose values as determined from the central age model (Galbraith, 1999)
 g-value: fading rate as described by Auclair et al. (2003)
 tc: reference time for fading measurement (Auclair et al., 2003)
 Age unbleached: Dose / Dose rate; no "unbleached" age is quoted for samples where the fading correction method by Wallinga et al (2007) was used
 Age: the final age, after fading correction where applicable
 Beach height: Height of the beach in m, where the sample was collected.

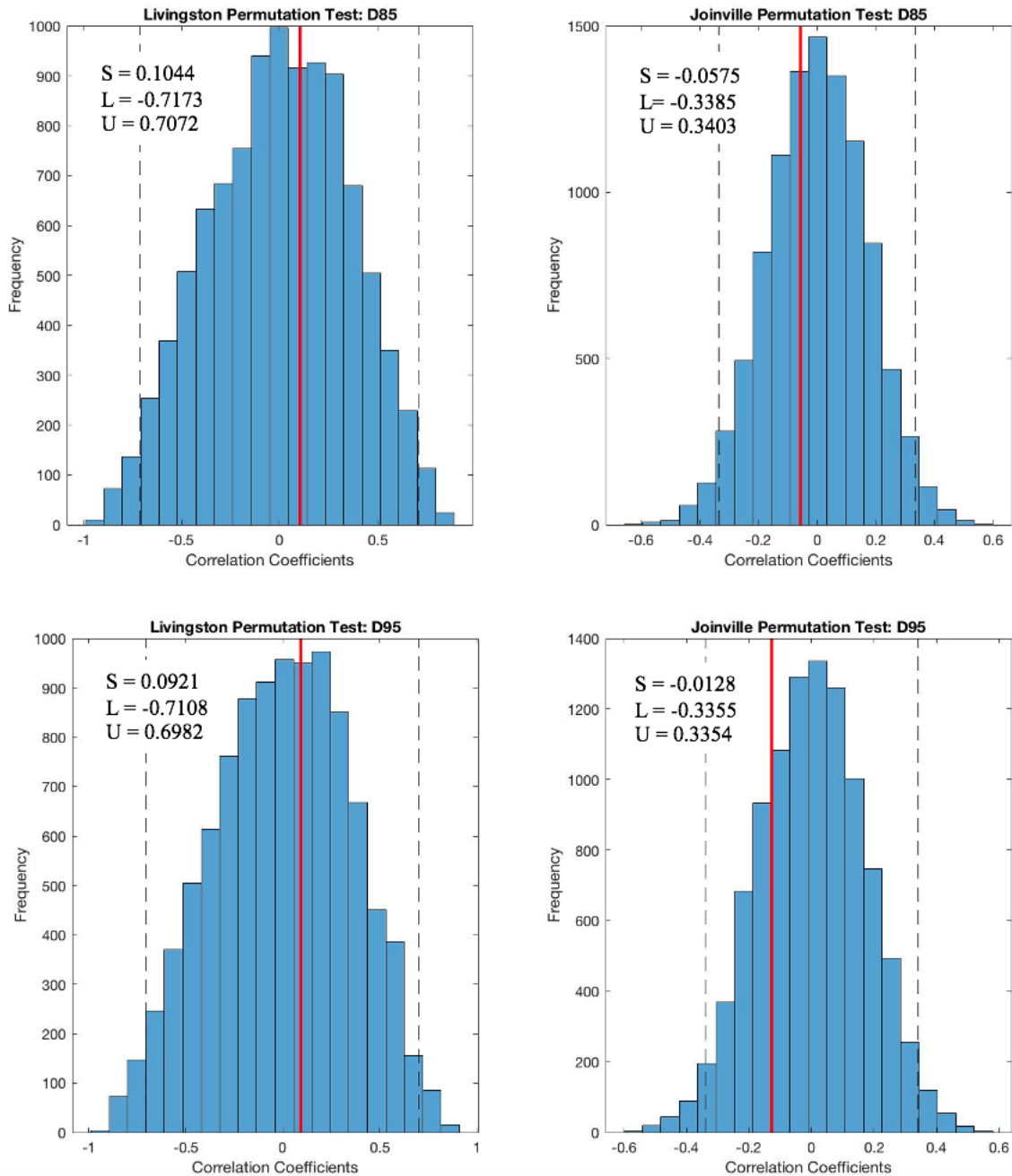


Figure S1: Permutation significance test results for the sample correlation coefficients between average roundness and average D95 and D85 grain sizes. Each permutation test was performed using 10,000 iterations of permuted pairs. The red lines depicted in each graph are the sample correlation coefficients (S) and the dashed lines are the upper (U) and lower (L) bounds of the 95% confidence interval. Each sample correlation coefficient remains within the 95% confidence interval, indicating the grain size and roundness data are uncorrelated. Complete grain size, roundness, and ice rafted debris data can be found at: <https://doi.org/10.15784/601400>