GSA Data Repository Items for "Mountain erosion over 10-year, 10 000-year, and 10 000 000-year time scales", by James W. Kirchner, Robert C. Finkel, Clifford S. Riebe, Darryl E. Granger, James L. Clayton, John G. King, and Walter F. Megahan

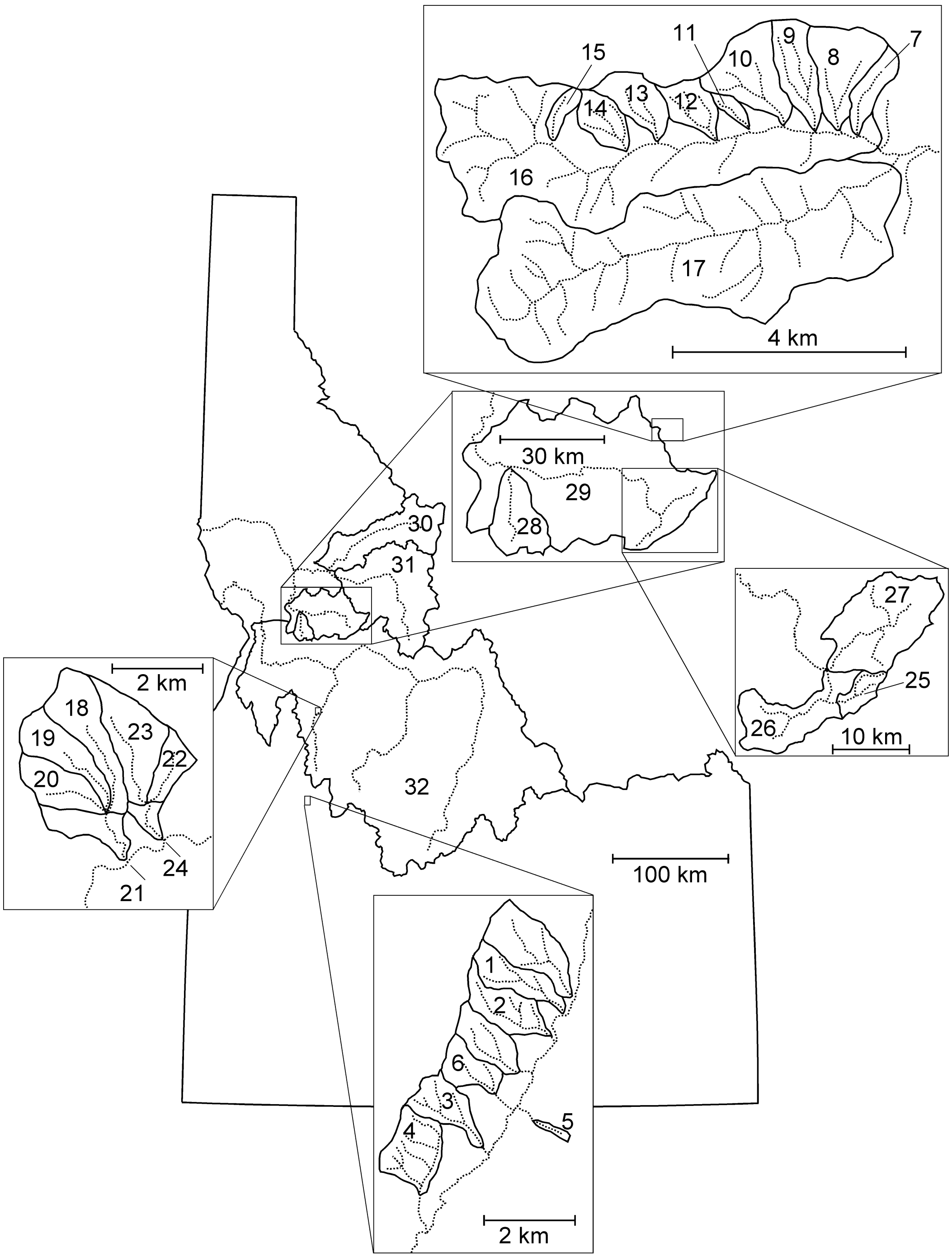

Figure A. Study catchment boundaries (solid lines) and major streams (dotted lines), superimposed on outline map of the state of Idaho. Catchment identification numbers are keyed to Table A.

TABLE A. CATCHMENT CHARACTERISTICS AND SEDIMENT YIELDS

Catchment ID*	Name	Latitude	Longitude	Drainage area (km^2)	Altitude range (m)	Glaciated area (%)	Short-term rates: Record length (yr)	Short-term rates: Sediment yield† (T•km^{-2}•yr^{-1})	Long-term (cosmogenic) rates: ^{10}Be concentration§ (10^5 atom•g^{-1})	Long-term (cosmogenic) rates: Time scale (yr)	Long-term (cosmogenic) rates: Sediment yield# (T•km^{-2}•yr^{-1})
Silver Creek											
1	SC-2	44º22'20"	115º45'59"	1.2	1463-2073	0	27	13.2 ± 2.2	0.92 ± 0.04	5 100	327 ± 42
2	SC-3	44º22'06"	115º46'12"	1.3	1451-2066	0	28	8.9 ± 1.4	1.61 ± 0.06	9 400	174 ± 23
3	SC-5	44º20'46"	115º47'18"	1.1	1390-1772	0	28	10.9 ± 1.6	1.87 ± 0.07	12 000	136 ± 18
4	SC-6	44º20'15"	115º48'20"	1.6	1381-1784	0	27	9.3 ± 1.7	1.72 ± 0.11	11 000	152 ± 22
5	SC-7	44º21'01"	115º46'30"	0.23	1457-1819	0	22	14.4 ± 2.5	2.88 ± 0.11	17 000	90 ± 12
6	SC-8	44º21'21"	115º47'02"	1.1	1415-1720	0	13	30.0 ± 10.6	2.06 ± 0.09	13 000	121 ± 16
Horse Creek											
7	HC-2	45º59'37"	115º20'27"	0.57	1268-1744	0	10	7.3 ± 1.3	2.46 ± 0.09	16 000	97 ± 13
8	HC-4	45º59'44"	115º20'39"	1.4	1280-1747	0	10	3.5 ± 0.6	2.71 ± 0.11	18 000	89 ± 12
9	HC-6	45º59'37"	115º21'00"	1.0	1293-1726	0	15	3.3 ± 0.6	2.94 ± 0.11	19 000	80 ± 11
10	HC-8	45º59'41"	115º21'26"	1.5	1317-1726	0	12	11.0 ± 3.0	2.64 ± 0.13	17 000	90 ± 13
11	HC-9	45º59'37"	115º21'53"	0.23	1341-1646	0	10	8.6 ± 1.3	2.86 ± 0.09	19 000	80 ± 11
12	HC-10	45º59'32"	115º22'19"	0.65	1354-1729	0	12	9.9 ± 2.4	2.58 ± 0.09	17 000	92 ± 13
13	HC-12	45º59'30"	115º23'07"	0.83	1390-1804	0	14	8.2 ± 2.3	2.48 ± 0.08	16 000	101 ± 14
14	HC-14	45º59'24"	115º23'30"	0.62	1415-1804	0	12	7.5 ± 2.3	3.09 ± 0.15	19 000	80 ± 12
15	HC-16	45º59'27"	115º24'31"	0.21	1524-1768	0	13	25.1 ± 6.7	4.36 ± 0.15	27 000	55 ± 8
16	West Fork	45º59'30"	115º20'10"	17	1250-1804	0	23	5.0 ± 0.5	2.72 ± 0.07	18 000	87 ± 12
17	East Fork	45º59'20"	115º19'58"	14	1241-1835	0	23	2.5 ± 0.3	3.12 ± 0.09	20 000	76 ± 11
Tailholt & Circle End Creeks											
18	Tailholt A	45º03'11"	115º40'54"	2.2	1256-2369	0	21	11.0 ± 2.5	1.18 ± 0.07	6 300	264 ± 36
19	Tailholt B	45º03'10"	115º40'57"	1.6	1256-2141	0	22	14.6 ± 3.3	1.15 ± 0.05	6 400	262 ± 34
20	Tailholt C	45º03'09"	115º41'00"	1.4	1256-2073	0	22	13.7 ± 2.4	1.41 ± 0.05	8 200	202 ± 26
21	Tailholt Main	45º02'34"	115º40'38"	6.6	1091-2369	0	28	14.0 ± 2.8	1.22 ± 0.06	7 000	239 ± 32
22	Circle End A	45º03'17"	115º40'13"	0.8	1296-2015	0	N.D.	N.D.	1.23 ± 0.05	7 300	226 ± 29
23	Circle End B	45º03'16"	115º40'17"	2.3	1296-2369	0	N.D.	N.D.	1.26 ± 0.05	7 300	229 ± 30
24	Circle End Main	45º02'50"	115º40'01"	3.8	1083-2369	0	25	6.5 ± 1.1	1.30 ± 0.07	7 700	215 ± 29
Larger Streams and Rivers											
25	Trapper Creek	45º40'13"	115º19'47"	20	1476-2012	0	10	9.8 ± 1.6	4.67 ± 0.12	26 000	57 ± 8
26	South Fk. Red River	45º42'35"	115º20'37"	98	1320-2170	0	14	8.0 ± 1.4	4.65 ± 0.13	25 000	58 ± 8
27	Upper Red River	45º42'38"	115º20'34"	129	1320-2075	0	14	10.1 ± 1.6	3.03 ± 0.10	18 000	87 ± 12
28	Johns Creek	45º49'23"	115º53'18"	293	735-2551	32	10	7.6 ± 1.3	2.60 ± 0.09	15 000	108 ± 15
29	S. Fk. Clearwater Rvr	45º53'15"	116º01'47"	2 149	600-2551	7	25	7.6 ± 2.3	2.75 ± 0.09	17 000	91 ± 12
30	Lochsa River	46º09'04"	115º35'37"	3 055	465-2680	21	72	26.3 ± 2.8	1.05 ± 0.04	6 700	250 ± 32
31	Selway River	46º05'11"	115º30'59"	4 945	490-2709	21	70	24.5 ± 3.2	1.32 ± 0.07	8 100	205 ± 28
32	Salmon River	45º44'38"	116º19'39"	35 079	460-3859	10	84	13.7 ± 4.1	1.47 ± 0.08	6 300	261 ± 36

Notes for Table A

*Identification numbers are coded to map in Figure A.

†Sediment yields for catchments smaller than 20 km^2 were measured by trapping sediment behind small dams; the trapped sediment was measured and removed once or twice per year (Clayton and Megahan, 1986). Measurements of suspended sediment passing over the dams were used to correct for trap efficiency. Sediment yields for catchments larger than 20 km^2 were calculated from daily measurements of streamflow, scaled by bias-corrected (Ferguson, 1987) sediment rating curves derived from measurements of suspended sediment concentrations and bedload fluxes over a wide range of flows. Periods of record for sediment concentrations (and thus for construction of rating curves) were 10, 14, 14, 10, 5, 4, 4, and 16 years for catchments no. 25 through 32, respectively. Uncertainties (expressed as standard errors of means) were calculated from variability of annual fluxes. For catchments no. 32 and no. 29, bedload was estimated as 5% and 10% of total sediment flux, respectively, and standard errors were estimated at 30 percent of the mean. N.D. = not determined.

§40-gram samples of quartz were purified from sand-sized sediment by magnetic separation and by acid leaching (Kohl and Nishiizumi, 1992) (which also eliminates meteoric "garden variety" ^{10}Be), spiked with ~0.5 mg ^{9}Be, and dissolved in HF. Be was separated by ion chromatography and analyzed as $^{10}Be/^{9}Be$ by accelerator mass spectrometry at Lawrence Livermore National Laboratory.

#Long-term sediment yields were calculated from equation 1. Area-averaged P_n and P_m values were calculated from sea-level high-latitude ^{10}Be production rates 4.72±0.38 atoms•g^{-1}•yr^{-1} and 0.11±0.01 atoms•g^{-1}•yr^{-1} respectively (Riebe et al., 2000; Riebe et al., 2001), scaled for latitude and for the altitude distribution within each catchment (Lal, 1991). Using Nishiizumi et al.'s (Nishiizumi et al., 1996) sea-level high-latitude production rate of 5.8 atoms•g^{-1}•yr^{-1} would increase calculated sediment yields by ~20 percent. Production rates were corrected for quartz enrichment by chemical weathering (Small et al., 1999), and for topographic shielding (Dunne et al., 1999). We corrected for shielding by snow cover using site-specific relationships between altitude and average snow water equivalent measured at nearby snow survey sites. Weathering fluxes were estimated at W=10.7±0.4 T•km^{-2}•yr^{-1}, based on 11-yr chemical mass balances at four Silver Creek catchments (Clayton and Megahan, 1986).

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APPENDIX A

To test whether shallow debris flows have a measurable effect on cosmogenic nuclide concentrations, we sampled and analyzed sand-sized material at two points along the debris flow scar at Circle End Creek (samples no. 22 and no. 24 in Table A). These samples yielded cosmogenic nuclide concentrations and long-term erosion rates that were indistinguishable from those of an undisturbed Circle End tributary (catchment no. 23) and adjacent undisturbed Tailholt Creek (catchments 18-21). This indicates that cosmogenic nuclide measurements of long-term erosion rates are not substantially affected by recent debris-flow activity, because the time required for a typical sediment grain to be exhumed from a hillslope and transported to a small channel or hollow is much longer than the timescale of its subsequent storage there. Thus the cosmogenic nuclide signature is primarily acquired during hillslope exhumation and transport, with channel storage having little effect on either nuclide production or decay (the latter requiring storage at depths >1 m for timescales >1 Myr, which is implausible at our sites).