Methods, Supplemental Files

METHODS

Sample preparation and data reduction including blank subtraction

Samples were prepared at the University of Vermont between 2002 and 2012 in batches (see Supplementary data table A1). Earlier batches (224-289) were extracted using the techniques described by Kohl and Nishiizumi, 1992 in Bierman and Caffee (2001). The later batches (462-493) were extracted using the techniques described in Corbett et al. (2011). Earlier batches used a SPEX 1000 ppm ICP Be standard as a carrier. Later batches used beryl carrier made at the University of Vermont. We used an average and standard deviation of each type of carrier for blank correction of the appropriate batches. For earlier batches, the median blank correction was 1.7% and the average, 7.9%. For later batches, using beryl carrier, the median blank correction was 0.26% and the average, 1.1%. Because similar amounts of carrier were used for the samples and for the blanks, corrections were made by subtracting the blank isotopic ratio from the measured isotopic ratio and uncertainties were propagated in quadrature.

Isotopic analyses were normalized to a variety of different primary standards with different assumed values (Nishiizumi et al., 2007) as listed in the supplementary data table. We used the production rate-scaling scheme of Stone (2000) to compute an effective elevation. We used the CRONUS calculator (Balco et al., 2008) to normalize these data so that erosion rates are comparable across the entire data set.

Bedrock-erosion calculations

For samples from bedrock sites, we computed erosion rates from subsurface samples under the assumption that the nuclide concentration in each sample had reached equilibrium with a steady erosion rate (see Balco and Shuster, 2009) and accounted for production of ^{10}Be and ^{26}Al by both spallation and muons. To estimate mass depth, we used the modern depth-density relations reported by Dethier and Lazarus (2006). Calculations of production rates due to muons used the method of Heisinger *et al.* (2002a,b) as implemented in Balco *et al.* (2008). However, we used revised muon interaction cross-sections inferred from an Antarctic sandstone core analyzed as part of the CRONUS-Earth project (John Stone, written communication, 2012). These cross-sections are, for Be-10, f* = 0.0011 and $sigma_0$ = 0.81 microbarns; for Al-26, f* = 0.0084 and $sigma_0$ = 13.6 microbarns. These cross-sections predict significantly lower production rates than the experimental cross-sections measured by Heisinger and yield an improved match to geological data (Balco *et al*., 2008; Braucher *et al*., 2011). Uncertainties reflect only measurement uncertainty. Erosion rates are unlikely to be steady over the (Myr) timescale necessary to achieve equilibrium nuclide concentrations.

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Table DR1. List of geomorphic measurements and cosmogenic radionuclide parameters for individual basins used in this study and notes about bedrock-erosion calculations.

Table 1, Supplemental Files

Sample number	Catchment name	Drainage area*	Mean basin slope†	Precip.§	Rock type#	Material**	10Be	± 1s (internal)††	Model Be erosion rate	±1s (external)††	Lab ref. number§§	Effective basin elevation##	Longitude***	Latitude***	Erosion-rate-measurement
		km^2	degrees	cm			atoms/g	atoms/g	mm/ky	mm/ky		m	DD	DD	
DC-01-01	Tungsten Gulch	1.69	11.8	46	G	S	6.862E+05	1.243E+04	31.4	2.56	B224	2588	-105.47860	39.96708	Small basin
DC-01-03	Deer Creek	11.06	15.1	57	G	S	1.308E+06	3.651E+04	18.48	1.55	B265	2711	-105.34761	39.85627	Small basin
DC-01-04	Cottonwood Gulch	9.77	21.6	45	Gn	S	9.785E+05	3.009E+04	23.3	1.96	B265	2599	-105.42487	39.76333	Small basin
DC-01-05	Elk Creek	17.15	17.0	45	Gn	S	9.512E+05	2.886E+04	20.72	1.78	B224	2466	-105.33135	39.74270	Small basin
DC-01-05r	Elk Creek (sample split)	17.15	17.0	45	Gn	S	1.082E+06	3.020E+04	19.35	1.61	B265	2466	-105.33135	39.74270	Small basin
DC-01-06	Forsythe Creek	10.00	10.8	46	G	S	6.275E+05	1.383E+04	32.77	2.7	B225	2506	-105.40362	39.95982	Small basin
DC-01-09	Ironclad Gulch	13.81	15.1	58	G	S	1.264E+06	2.561E+04	18.98	1.6	B224	2791	-105.47106	40.15697	Small basin
DC-01-11	Deadman Gulch	3.06	20.9	45	G	S	6.819E+05	1.991E+04	22.39	1.88	B229	2024	-105.32089	40.20262	Small basin
DC-01-12	Little Thompson River trib.	1.90	19.5	45	G	S	1.438E+06	4.201E+04	14.86	1.26	B265	2498	-105.38116	40.28524	Small basin
DC-01-14	Long Gulch	6.26	23.5	45	G	S	1.167E+06	2.728E+04	17.14	1.45	B229	2478	-105.40022	40.41144	Small basin
DC-01-16	Young Gulch	39.51	18.4	45	G	S	8.423E+05	1.750E+04	21.62	1.78	B229	2297	-105.34734	40.68586	Small basin
DC-01-19	Lake Catamount	2.80	18.6	58	Gn	S	7.460E+05	1.435E+04	29.51	2.43	B229	2618	-106.79401	40.33905	Small basin
OW-01-07	Heather Creek	9.86	11.5	75	G	S	8.029E+05	1.763E+04	30.75	2.57	B225	2778	-106.94451	41.25387	Small basin
JFC-02-03	Pole Creek #1	3.73	21.4	60	G	S	7.336E+05	3.096E+04	37.67	3.35	B260	2896	-105.82614	40.20130	Small basin
MJ-BC-01	Guinn Mtn	0.51	8.0	70	G (BC)	S	1.688E+06	5.323E+04	19.48	1.68	B286	3341	-105.63527	39.93970	Small basin
MJ-BC-17	Saddle stream	0.24	8.5	84	Qm	S	1.136E+06	1.392E+04	28.94	2.41	B467	3517	-105.59228	40.04903	Small basin
JFW-02-13	North Crow Creek	7.83	6.7	45	G (S)	S	9.672E+05	3.040E+04	22.81	1.92	B286	2572	-105.34445	41.21334	Small basin
DC-03-03	Lily Mtn	0.00	50.0	50	G (LP)	G	1.375E+06	1.620E+04	17.01	1.41	B462	2910	-105.53976	40.31797	Tor
DC-05-05	Lily Mtn area	0.01	32.0	50	G (LP)	G	1.080E+06	1.275E+04	20.68	1.7	B462	2818	-105.54225	40.31125	Tor
JFC-02-01	Ironclads	0.00	50.0	57	G (LP)	G	1.102E+06	3.396E+04	22.88	1.93	B260	2759	-105.48731	40.16443	Tor
DC-09-18	Gordon Gulch stream seds., lower	3.50	15.1	45	Gn	S	9.102E+05	1.049E+04	19.41	1.58	B465	2433	-105.45851	40.01299	Small basin
DC-09-20	Gordon Gulch stream seds., upper	0.90	12.8	45	Gn	S	1.270E+06	2.223E+04	14.97	1.25	B465	2573	-105.47519	40.01743	Small basin
MJ-BC-19	Arapaho moraine	0.46	7.7	70	M	S	1.421E+06	4.448E+04	18.66	1.6	B286	2949	-105.53422	40.02302	Moraine
DC-03-A2	Eldora moraines	0.02	18.6	45	M	S	5.131E+05	5.697E+03	38.46	3.07	B467	2589	-105.53030	39.95574	Moraine
MJ-BC-12	M. Boulder Cr. trib.	0.40	14.6	89	Gn	S	1.303E+06	1.453E+04	25.27	2.11	B467	3530	-105.64016	39.97955	Alpine
MJ-BC-02	Niwot Ridge stream	0.44	9.3	83	G (BC)	S	1.215E+06	3.820E+04	30.17	2.59	B286	3518	-105.58776	40.06334	Alpine
MJ-BC-14	Arikaree talus	0.05	35.1	93	G (BC)	S	9.849E+05	3.024E+04	46.54	3.98	B266	3847	-105.63416	40.04869	Alpine
MJ-BC-15	Niwot Ridge talus	0.02	40.0	93	G (BC)	S	4.340E+05	1.813E+04	81.69	7.46	B467	3630	-105.628674	40.054405	Alpine
MJ-BC-16	Martinelli stream	0.24	9.1	84	Qm	S	2.182E+06	5.733E+04	17.45	1.49	B265	3524	-105.59585	40.05085	Alpine
DC-01-07	Calhoun Gulch	2.30	19.9	45	G	S	4.774E+05	1.342E+04	41.88	3.38	B265	2338	-105.38275	39.99087	Canyon edge
DC-01-08	Long Gulch	4.31	20.5	45	Gn	S	6.269E+05	8.021E+03	29.89	2.41	B462	2508	-105.42081	40.03905	Canyon edge
WBO-CO-10-2	Fourmile trib; from Sugarloaf	0.53	28.5	45	G (BC)	S	3.534E+05	*1.066E+04*	51.25	4.29	COW102	*2446*	-105.4218	40.0316	Canyon edge
WBO-CO-10-3	Arkansas gulch,Fourmile Creek trib.	0.81	27.5	45	G (BC)	S	2.353E+05	*1.314E+04*	62.92	5.96	COW103	*2098*	-105.3611	40.0332	Canyon edge

Table DR1. List of geomorphic measurements and cosmogenic radionuclide parameters for individual basins used in this study and notes about bedrock-erosion calculations.

WC-11-3	Trib., M. Boulder Creek	0.96	17.4	45	G (BC)	S	4.873E+05	*1.176E+04*	38.95	3.22	COW113	*2536*	-105.4472	39.9750	Canyon edge
WC-11-4	Trib., M. Boulder Creek	0.17	29.0	45	G (BC)	S	2.937E+05	*7.258E+03*	50.21	4.04	COW114	*2101*	-105.3665	40.0077	Canyon edge
WC-11-5	Trib., M. Boulder Creek	0.46	23.3	45	G (BC)	S	3.135E+05	*7.642E+03*	45.54	3.66	COW115	*2051*	-105.3368	39.9997	Canyon edge
WC-11-6	Trib., M. Boulder Creek	0.12	35.6	45	G (BC)	S	2.363E+05	*5.463E+03*	55.29	4.36	COW116	*1897*	-105.3106	40.0090	Canyon edge
WC-11-7	Trib., M. Boulder Creek	0.26	21.2	45	G (BC)	S	3.555E+05	*9.720E+03*	49.05	4.05	COW117	*2382*	-105.4172	40.0036	Canyon edge
DC-01-17	Jimmy Creek	11.21	14.8	57	F	S	6.335E+05	8.281E+03	37.11	3.02	B462	2859	-105.86538	40.87697	Small basin
DC-01-18	Agate Creek	4.12	11.8	57	F	S	3.891E+05	8.936E+03	47.58	3.85	B225	2301	-106.84828	40.43305	Small basin
OW-01-08	Stinking Creek	47.30	6.7	38	F	S	6.477E+04	5.007E+03	286.62	31.09	B225	2196	-106.40581	42.39902	Small basin
OW-01-09	Willow Creek trib	2.01	9.3	32	F	S	1.627E+05	3.837E+03	88.82	7.01	B462	1950	-106.77041	42.66913	Small basin
OW-01-11	Government Slide	1.36	10.0	24	F	S	1.356E+05	4.837E+03	117.29	9.74	B225	1954	-108.22310	42.67184	Small basin
JFC-02-02	Willow Creek	0.93	13.2	41	F	S	3.850E+05	1.240E+04	59.68	4.91	B285	2656	-105.94245	40.15982	Small basin
JFC-02-04	Pole Creek #2	1.53	6.5	45	F	S	7.688E+05	2.383E+04	36.84	3.09	B260	2951	-105.91326	39.97639	Small basin
JFC-02-05	Spring Creek, trib.Beaver Creek	3.65	14.6	45	F	S	3.810E+05	1.673E+04	62.91	5.46	B285	2746	-106.09860	40.03033	Small basin
JFC-02-06	Williams Creek	0.47	4.9	41	F	S	9.230E+05	2.854E+04	23.31	1.95	B260	2495	-106.16801	39.99371	Small basin
JFC-O2-07	Lawson Creek	22.75	9.4	45	F	S	6.100E+05	1.891E+04	41.66	3.47	B260	2749	-106.90431	40.18687	Small basin
JFC-02-08	Todd Creek	8.02	11.5	45	F	S	2.349E+05	7.393E+03	110.82	9.14	B260	2760	-106.87395	40.10648	Small basin
JFC-02-09	Floyd Creek	11.60	13.4	70	F	S	2.015E+05	6.398E+03	142.15	11.82	B260	2895	-106.98873	40.80020	Small basin
JFC-02-10	Lost Creek	5.79	10.8	45	F	S	6.898E+05	*2.125E+04*	38.58	3.22	B263	2819	-106.25915	40.48241	Small basin
JFC-02-11	Spring Creek #1	1.76	7.6	38	F	S	4.957E+05	1.753E+04	46.13	3.89	B285	2634	-106.23566	40.61154	Small basin
JFC-02-12	Spring Creek #2	12.46	4.9	38	F	S	4.097E+05	1.316E+04	55.82	4.61	B285	2628	-106.18622	40.61221	Small basin
JFW-02-14	Muddy Creek	2.24	6.0	45	F	S	1.739E+05	6.963E+03	72.93	5.88	B286	1627	-104.09514	41.08733	Small basin
JFN-02-15	South Bridgeport	2.35	4.2	45	F	S	1.119E+05	7.492E+03	89.58	8.27	B286	1248	-102.97078	41.48188	Small basin
JFN-02-16	Braidon (Bratten) Creek	11.08	8.1	45	F	S	7.622E+04	4.480E+03	135.02	11.55	B285	1273	-103.04742	41.74376	Small basin
JFN-02-17	South Scotts Bluff	1.05	18.9	43	F	S	4.558E+04	1.666E+04	197.69	52.97	B289	1336	-103.67826	41.71896	Small basin
JFN-02-18	Middle Bear Creek	0.33	7.0	32	F	S	1.418E+05	7.057E+03	84.8	7.17	B285	1511	-105.04536	42.39568	Small basin
JFC-02-21	Pawnee National Grasslands	4.04	13.7	45	F	S	8.650E+04	4.435E+03	115.96	9.56	B287	1407	-103.68950	40.90659	Small basin
JFC-02-22	Sawmill Gulch, Willow Cr. Trib.	9.79	16.7	57	F	S	2.651E+05	1.558E+04	100.1	9.21	B289	2931	-106.05971	40.22957	Small basin
OW-01-12	Skull Creek	3.59	12.7	45	Q	S	1.724E+06	3.268E+04	12.61	1.07	B225	2630	-109.53062	40.86123	Small basin
JFW-02-20	Medicine Bow Peak #2	0.01	8.5	108	Q	G	3.192E+06	9.901E+04	12.03	1.06	B288	3590	-106.32185	41.35929	Small basin
MJ-BC-04	Niwot Ridge (Ni)	na	na	83	G (LP)	R	1.868E+05	2.504E+03	11.17	0.17	B465	3556	-105.58526	40.05677	Bedrock
MJ-BC-11	Birk. (B)	na	na	95	G (LP)	R	3.426E+04	5.791E+03	28.7	5.8	B286	3597	-105.65058	39.98259	Bedrock
MJ-PRFL-3a	Nederland saprolite (N)	na	na	45	Gn	Sa	2.561E+05	9.167E+03	29.3	1.1	B287	2622	-105.49699	39.99653	Bedrock
MJ-PRFL-3b	Nederland saprolite (N)	na	na	45	Gn	R	3.003E+04	4.329E+03	17.4	3.5	B287	2622	-105.49699	39.99653	Bedrock
MJ-PRFL-3c	Nederland saprolite (N)	na	na	45	Gn	R	2.698E+04	5.483E+03	10.9	4.0	B287	2622	-105.49699	39.99653	Bedrock
MJ-PRFL-3d	Nederland saprolite (N)	na	na	45	Gn	S	9.399E+05	3.641E+04	17.95	0.71	B287	2622	-105.49699	39.99653	Bedrock
MJ-PRFL-3e	Nederland saprolite (N)	na	na	45	Gn	Sa	3.434E+04	3.561E+03	31.2	3.8	B287	2622	-105.49699	39.99653	Bedrock
MJ-PRFL-3f	Nederland saprolite (N)	na	na	45	Gn	R	2.851E+04	3.248E+03	12.6	2.3	B287	2622	-105.49699	39.99653	Bedrock
MJ-PRFL-3g	Nederland saprolite (N)	na	na	45	Gn	R	1.764E+04	4.508E+03	18.4	7.9	B289	2622	-105.49699	39.99653	Bedrock

Table DR1. List of geomorphic measurements and cosmogenic radionuclide parameters for individual basins used in this study and notes about bedrock-erosion calculations.

DPD-1	Pike's Peak saprolite (PP)	na	na	38	G	R	2.838E+04	3.659E+03	7.8	2.1	B285	2516	-105.27768	38.95020	Bedrock
DC-03-04	Ferncliff big cut (F)	na	na	57	G (SP)	R	1.257E+04	7.001E+02	28.2	2.3	B462	2513	-105.50990	40.18996	Bedrock
DC-03-05	Cave Creek site (CC)	na	na	57	G (SP)	R	1.946E+04	7.505E+02	9.64	0.76	B462	2482	-105.46612	40.15946	Bedrock
DC-03-06	South of Ward (W)	na	na	57	Gn	R	2.556E+04	1.051E+03	9.00	0.72	B467	2813	-105.51504	40.05079	Bedrock
DC-04-45	Gold Hill RR cut (GH)	na	na	45	Gn	R	2.115E+04	8.597E+02	15.10	0.99	B467	2626	-105.45445	40.04947	Bedrock
DC-04-90	Moffat Pass RR cut (M)	na	na	83	Gn	R	2.185E+04	6.892E+02	21.06	0.93	B462	3520	-105.66688	39.94149	Bedrock

*We used ArcGIS and RiverTools (http://rivix.com/) to extract catchment area, area-elevation distribution and slope for individual basins using 10 m USGS DEMs for most areas, supplemented by 30 m DEMs for several areas of Wyoming and Nebraska.

†Basin slope from ArcGIS

§Precipitation: http://prism.oregonstate.edu

#Rock type: G= granitic (BC=Boulder Creek; LP = Long's Peak;S= Sherman); Gn=gneiss or metasediments; F= Tertiary sedimentary rocks; Q=quartzite;Qm= quartz monzonite; M= mixed granitic rock types

**Material: S = alluvial sediment; R = rock; Sa=saprolite;G = grus

†† Internal uncertainty calculated from laboratory and internal blanks; external uncertainty refers to uncertainties calculated from measurement and production-rate uncertainties

§§University of Vermont Cosmogenic Nuclide Laboratory number; batches B224-289 were analyzed at the Center for Mass Spectrometry, Lawrence Livermore National Laboratory; B462-467 and COW samples were analyzed at the Scottish Universities Environmental Research Centre (SUERC); shielding factor is 1.0 in all cases; sample thickness is 0 cm for sediment and 3 cm for rock and saprolite; rock density for model erosion rate is 2.65 g cm^{-3}

Hypsometrically-weighted effective elevation

*** Sample location

Table DR2, Supplemental Files

Batch	Sample	Quartz	10Be (atoms/g) (background corrected), 1σ (AMS analytical uncertainty only)		Carrier mass (ug Be)	Carrier type	AMS lab	Run date	Run ID	BE#	Measured ratio		Blank ratio		Blank corrected ratio (ratio and background uncertainties propagated in quadrature)		Standard CRONUS name	Assumed std value 10Be/9Be Ratio (x 10-15)
											$^{10}Be/^{9}Be$ Ratio	1σ uncertainty	$^{10}Be/^{9}Be$ Ratio	1σ uncertainty	$^{10}Be/^{9}Be$ Ratio	1σ uncertainty		
224	dc-01-1	31.42	6.86E+05	1.24E+04	249.8	SPEX 1000 ppm	LLNL	04/25/02	224DC01-1	BE15436	1.313E-12	2.289E-14	2.141E-14	4.831E-15	1.292E-12	2.340E-14	KNSTD	3153
224	dc-01-5	29.84	9.51E+05	2.89E+04	249.8	SPEX 1000 ppm	LLNL	04/25/02	224DC01-5	BE15437	1.722E-12	5.137E-14	2.141E-14	4.831E-15	1.701E-12	5.160E-14	KNSTD	3153
224	dc-01-9	19.01	1.26E+06	2.56E+04	250.7	SPEX 1000 ppm	LLNL	04/25/02	224DC01-9	BE15438	1.456E-12	2.866E-14	2.141E-14	4.831E-15	1.434E-12	2.906E-14	KNSTD	3153
225	dc-01-6	31.70	6.27E+05	1.38E+04	249.8	SPEX 1000 ppm	LLNL	04/25/02	225DC01-6	BE15441	1.213E-12	2.583E-14	2.141E-14	4.831E-15	1.192E-12	2.628E-14	KNSTD	3153
225	dc-01-18	30.77	3.89E+05	8.94E+03	250.7	SPEX 1000 ppm	LLNL	04/25/02	225DC01-18	BE15440	7.359E-13	1.568E-14	2.141E-14	4.831E-15	7.145E-13	1.641E-14	KNSTD	3153
225	ow-01-7	27.02	8.03E+05	1.76E+04	250.7	SPEX 1000 ppm	LLNL	04/25/02	225OW-01-7	BE15442	1.316E-12	2.801E-14	2.141E-14	4.831E-15	1.295E-12	2.843E-14	KNSTD	3153
225	ow-01-8	24.21	6.48E+04	5.01E+03	250.7	SPEX 1000 ppm	LLNL	04/25/02	225OW-01-8	BE15443	1.150E-13	5.387E-15	2.141E-14	4.831E-15	9.359E-14	7.235E-15	KNSTD	3153
225	ow-01-11	24.15	1.36E+05	4.84E+03	249.8	SPEX 1000 ppm	LLNL	04/25/02	225OW-01-11	BE15444	2.176E-13	5.065E-15	2.141E-14	4.831E-15	1.962E-13	6.999E-15	KNSTD	3153
225	ow-01-12	41.06	1.72E+06	3.27E+04	250.7	SPEX 1000 ppm	LLNL	04/25/02	225OW-01-12	BE15445	4.246E-12	7.995E-14	2.141E-14	4.831E-15	4.225E-12	8.009E-14	KNSTD	3153
229	dc-01-11	30.74	6.82E+05	1.99E+04	248.8	SPEX 1000 ppm	LLNL	04/26/02	229DC01-11	BE15471	1.282E-12	3.651E-14	2.141E-14	4.831E-15	1.261E-12	3.683E-14	KNSTD	3153
229	dc-01-14	29.41	1.17E+06	2.73E+04	351.8	SPEX 1000 ppm	LLNL	04/26/02	229DC01-14	BE15472	1.482E-12	3.378E-14	2.141E-14	4.831E-15	1.460E-12	3.412E-14	KNSTD	3153
229	dc-01-16	25.15	8.42E+05	1.75E+04	249.8	SPEX 1000 ppm	LLNL	04/26/02	229DC01-16	BE15473	1.291E-12	2.592E-14	2.141E-14	4.831E-15	1.269E-12	2.637E-14	KNSTD	3153
229	dc-01-19	28.10	7.46E+05	1.44E+04	249.8	SPEX 1000 ppm	LLNL	04/26/02	229DC01-19	BE15474	1.277E-12	2.368E-14	2.141E-14	4.831E-15	1.256E-12	2.416E-14	KNSTD	3153
260	jfc-02-1	33.61	1.08E+06	2.57E+04	253.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-1	BE18030	2.169E-12	5.073E-14	2.141E-14	4.831E-15	2.147E-12	5.096E-14	LLNL3000	3000
260	jfc-02-03	39.61	7.21E+05	2.71E+04	252.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-03	BE18031	1.711E-12	6.336E-14	2.141E-14	4.831E-15	1.690E-12	6.355E-14	LLNL3000	3000
260	jfc-02-04	40.37	7.55E+05	1.81E+04	255.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-04	BE18032	1.806E-12	4.260E-14	2.141E-14	4.831E-15	1.784E-12	4.287E-14	LLNL3000	3000
260	jfc-02-06	38.49	9.07E+05	2.17E+04	252.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-06	BE18033	2.089E-12	4.916E-14	2.141E-14	4.831E-15	2.067E-12	4.939E-14	LLNL3000	3000
260	jfc-02-07	39.54	5.99E+05	1.45E+04	251.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-07	BE18034	1.429E-12	3.362E-14	2.141E-14	4.831E-15	1.408E-12	3.397E-14	LLNL3000	3000
260	jfc-02-08	39.81	2.30E+05	5.99E+03	252.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-08	BE18035	5.628E-13	1.327E-14	2.141E-14	4.831E-15	5.414E-13	1.412E-14	LLNL3000	3000
260	jfc-02-09	38.43	1.97E+05	5.33E+03	253.7	SPEX 1000 ppm	LLNL	06/27/03	260JFC-02-09	BE18036	4.674E-13	1.108E-14	2.141E-14	4.831E-15	4.459E-13	1.209E-14	LLNL3000	3000
263	jfc-02-10	34.36	6.78E+05	1.62E+04	251.7	SPEX 1000 ppm	LLNL	08/29/03	263jfc0201	BE18408	1.406E-12	3.269E-14	2.141E-14	4.831E-15	1.384E-12	3.305E-14	LLNL3000	3000
265	dc01-3	39.51	1.29E+06	2.53E+04	251.7	SPEX 1000 ppm	LLNL	02/28/04	265dc01-3	BE18520	3.042E-12	5.922E-14	2.141E-14	4.831E-15	3.021E-12	5.941E-14	LLNL3000	3000
265	dc-01-4	28.82	9.61E+05	2.28E+04	250.7	SPEX 1000 ppm	LLNL	02/28/04	265dc-01-4	BE18521	1.674E-12	3.890E-14	2.141E-14	4.831E-15	1.653E-12	3.920E-14	LLNL3000	3000
265	dc-01-5	34.66	1.06E+06	2.10E+04	252.7	SPEX 1000 ppm	LLNL	02/28/04	265dc-01-5	BE18522	2.203E-12	4.280E-14	2.141E-14	4.831E-15	2.182E-12	4.307E-14	LLNL3000	3000
265	dc-01-7	40.01	4.68E+05	9.52E+03	251.7	SPEX 1000 ppm	LLNL	02/28/04	265dc-01-7	BE18523	1.135E-12	2.212E-14	2.141E-14	4.831E-15	1.114E-12	2.264E-14	LLNL3000	3000
265	dc-01-12	32.83	1.41E+06	3.04E+04	251.7	SPEX 1000 ppm	LLNL	02/28/04	265dc-01-12	BE18524	2.779E-12	5.919E-14	2.141E-14	4.831E-15	2.758E-12	5.938E-14	LLNL3000	3000
265	mjbc16	19.07	2.14E+06	3.70E+04	250.7	SPEX 1000 ppm	LLNL	02/28/04	265mjbc16	BE18526	2.462E-12	4.189E-14	2.141E-14	4.831E-15	2.440E-12	4.217E-14	LLNL3000	3000
266	mjbc14	34.93	9.70E+05	2.28E+04	250.7	SPEX 1000 ppm	LLNL	08/29/03	266mjbc14	BE18430	2.043E-12	4.735E-14	2.141E-14	4.831E-15	2.022E-12	4.760E-14	LLNL3000	3000
285	dpd 1	39.95	2.99E+04	3.03E+03	304.3	SPEX 1000 ppm	LLNL	07/29/04	285dpd1	BE19440	8.018E-14	3.488E-15	2.141E-14	4.831E-15	5.877E-14	5.958E-15	KNSTD	3153
285	JFC02-2	26.04	3.82E+05	9.18E+03	304.3	SPEX 1000 ppm	LLNL	07/29/04	285JFCO2-02	BE19441	5.108E-13	1.071E-14	2.141E-14	4.831E-15	4.894E-13	1.175E-14	KNSTD	3153
285	JFC02-05	14.12	3.81E+05	1.37E+04	304.3	SPEX 1000 ppm	LLNL	07/29/04	285JFCO2-05	BE19442	2.858E-13	8.227E-15	2.141E-14	4.831E-15	2.644E-13	9.540E-15	KNSTD	3153
285	JFC02-11	32.58	4.91E+05	1.41E+04	304.3	SPEX 1000 ppm	LLNL	07/29/04	285JFCO2-11	BE19443	8.074E-13	2.213E-14	2.141E-14	4.831E-15	7.860E-13	2.266E-14	KNSTD	3153
285	JFC-02-12	38.13	4.05E+05	1.00E+04	299.3	SPEX 1000 ppm	LLNL	07/29/04	285JFCO2-12	BE19444	7.943E-13	1.846E-14	2.141E-14	4.831E-15	7.729E-13	1.909E-14	KNSTD	3153
285	JFN02-16	40.07	7.70E+04	3.72E+03	304.3	SPEX 1000 ppm	LLNL	07/29/04	285JFNO2-16	BE19445	1.732E-13	5.505E-15	2.141E-14	4.831E-15	1.518E-13	7.324E-15	KNSTD	3153
285	JFN02-18	35.98	1.42E+05	6.05E+03	302.3	SPEX 1000 ppm	LLNL	07/29/04	285JFNO2-18	BE19446	2.739E-13	9.630E-15	2.141E-14	4.831E-15	2.525E-13	1.077E-14	KNSTD	3153
286	JFW 02-13	38.23	9.54E+05	2.32E+04	299.3	SPEX 1000 ppm	LLNL	07/29/04	286JFW02-13	BE19448	1.846E-12	4.399E-14	2.141E-14	4.831E-15	1.824E-12	4.425E-14	KNSTD	3153
286	JFW02-14	40.11	1.73E+05	5.67E+03	303.3	SPEX 1000 ppm	LLNL	07/29/04	286JFW02-14	BE19449	3.642E-13	1.013E-14	2.141E-14	4.831E-15	3.428E-13	1.122E-14	KNSTD	3153
286	JFN02-15	29.56	1.13E+05	6.61E+03	302.3	SPEX 1000 ppm	LLNL	07/29/04	286JFW02-15	BE19450	1.866E-13	8.375E-15	2.141E-14	4.831E-15	1.651E-13	9.668E-15	KNSTD	3153
286	MJBC1	20.56	1.67E+06	4.06E+04	300.3	SPEX 1000 ppm	LLNL	07/29/04	286MJBC1	BE19451	1.728E-12	4.134E-14	2.141E-14	4.831E-15	1.707E-12	4.162E-14	KNSTD	3153
286	MJBC2	35.80	1.20E+06	2.91E+04	302.3	SPEX 1000 ppm	LLNL	07/29/04	286MJBC2	BE19452	2.146E-12	5.139E-14	2.141E-14	4.831E-15	2.124E-12	5.162E-14	KNSTD	3153
286	MJBC11	23.90	3.70E+04	4.74E+03	302.3	SPEX 1000 ppm	LLNL	07/29/04	286MJBC11	BE19453	6.519E-14	2.842E-15	2.141E-14	4.831E-15	4.378E-14	5.605E-15	KNSTD	3153
286	MJBC19	40.08	1.40E+06	3.39E+04	304.3	SPEX 1000 ppm	LLNL	07/29/04	286MJBC19	BE19454	2.784E-12	6.656E-14	2.141E-14	4.831E-15	2.762E-12	6.673E-14	KNSTD	3153

287	mjprfl-3A	24.69	2.55E+05	7.09E+03	250.7	SPEX 1000 ppm	LLNL	07/29/04	287mjprfkl-3A	BE19456	3.969E-13	9.265E-15	2.141E-14	4.831E-15	3.755E-13	1.045E-14	KNSTD	3153
287	mjprfl-3B	28.79	3.18E+04	3.65E+03	250.7	SPEX 1000 ppm	LLNL	07/29/04	287mjprfkl-3B	BE19457	7.608E-14	3.987E-15	2.141E-14	4.831E-15	5.467E-14	6.263E-15	KNSTD	3153
287	mjprfl-3C	27.27	2.90E+04	4.88E+03	253.7	SPEX 1000 ppm	LLNL	07/29/04	287mjprfkl-3C	BE19458	6.801E-14	6.186E-15	2.141E-14	4.831E-15	4.660E-14	7.849E-15	KNSTD	3153
287	mjprfl-3D	30.64	9.28E+05	3.08E+04	251.7	SPEX 1000 ppm	LLNL	07/29/04	287mjprfkl-3D	BE19459	1.711E-12	5.596E-14	2.141E-14	4.831E-15	1.690E-12	5.617E-14	KNSTD	3153
287	mjprfl-3E	33.25	3.58E+04	2.90E+03	250.7	SPEX 1000 ppm	LLNL	07/29/04	287mjprfkl-3e	BE19460	9.238E-14	3.137E-15	2.141E-14	4.831E-15	7.097E-14	5.760E-15	KNSTD	3153
287	mjprfl-3F	39.03	2.97E+04	2.72E+03	252.7	SPEX 1000 ppm	LLNL	07/29/04	287mjprfkl-3F	BE19461	9.016E-14	4.031E-15	2.141E-14	4.831E-15	6.875E-14	6.292E-15	KNSTD	3153
287	JFC02-21	40.18	8.68E+04	3.73E+03	252.7	SPEX 1000 ppm	LLNL	07/29/04	287JFCO2-21	BE19462	2.279E-13	7.438E-15	2.141E-14	4.831E-15	2.065E-13	8.869E-15	KNSTD	3153
288	jfw02-20	39.69	3.14E+06	7.50E+04	310.2	SPEX 1000 ppm	LLNL	07/29/04	288JFW02-20	BE19470	6.043E-12	1.435E-13	2.141E-14	4.831E-15	6.021E-12	1.436E-13	KNSTD	3153
289	jfc02-22	10.43	2.68E+05	1.26E+04	301.3	SPEX 1000 ppm	LLNL	07/29/04	289JFCO2-22	BE19475	1.605E-13	4.381E-15	2.141E-14	4.831E-15	1.391E-13	6.522E-15	KNSTD	3153
289	jfn02-17	7.72	5.49E+04	1.33E+04	300.3	SPEX 1000 ppm	LLNL	07/29/04	289JFNO2-17	BE19476	4.254E-14	1.688E-15	2.141E-14	4.831E-15	2.113E-14	5.117E-15	KNSTD	3153
289	mjprfi-3g	30.00	2.00E+04	3.67E+03	302.3	SPEX 1000 ppm	LLNL	07/29/04	289mjprfl-3g	BE19477	5.108E-14	2.522E-15	2.141E-14	4.831E-15	2.967E-14	5.450E-15	KNSTD	3153
462	dc-03-04	15.55	1.23E+04	7.04E+02	241.5	beryl	LLNL	09/04/11	462dc-03-04	BE30795	1.285E-14	5.290E-16	1.038E-15	4.247E-16	1.182E-14	6.783E-16	07KNSTD	2850
462	dc-01-17	22.60	6.29E+05	8.22E+03	248.1	beryl	LLNL	09/04/11	462dc-01-17	BE30796	8.580E-13	1.120E-14	1.038E-15	4.247E-16	8.570E-13	1.121E-14	07KNSTD	2850
462	ow-01-9	12.46	1.61E+05	3.81E+03	244.7	beryl	LLNL	09/04/11	462ow-01-9	BE30797	1.239E-13	2.875E-15	1.038E-15	4.247E-16	1.229E-13	2.906E-15	07KNSTD	2850
462	dc-03-03	21.99	1.37E+06	1.61E+04	246.1	beryl	LLNL	09/04/11	462dc-03-03	BE30798	1.827E-12	2.151E-14	1.038E-15	4.247E-16	1.826E-12	2.151E-14	07KNSTD	2850
462	dc-05-05	22.26	1.07E+06	1.27E+04	245.9	beryl	LLNL	09/04/11	462dc-05-05	BE30800	1.454E-12	1.715E-14	1.038E-15	4.247E-16	1.453E-12	1.715E-14	07KNSTD	2850
462	dc-01-08	15.22	6.22E+05	7.97E+03	246.3	beryl	LLNL	09/04/11	462dc-01-08	BE30801	5.763E-13	7.352E-15	1.038E-15	4.247E-16	5.753E-13	7.364E-15	07KNSTD	2850
462	dc-03-05	20.00	1.92E+04	7.50E+02	246.8	beryl	LLNL	09/04/11	462dc-03-05	BE30802	2.427E-14	8.051E-16	1.038E-15	4.247E-16	2.324E-14	9.103E-16	07KNSTD	2850
462	dc-04-90	22.65	2.15E+04	6.89E+02	246.4	beryl	LLNL	09/04/11	462dc-04-90	BE30803	3.068E-14	8.470E-16	1.038E-15	4.247E-16	2.964E-14	9.475E-16	07KNSTD	2850
465	DC-06-03	20.54	6.44E+05	7.44E+03	243.5	beryl	LLNL	09/04/11	465DC-06-03	BE30831	8.147E-13	9.381E-15	1.038E-15	4.247E-16	8.137E-13	9.391E-15	07KNSTD	2850
465	DC-09-18	15.05	9.04E+05	1.04E+04	245.5	beryl	LLNL	09/04/11	465DC-09-18	BE30832	8.301E-13	9.549E-15	1.038E-15	4.247E-16	8.291E-13	9.558E-15	07KNSTD	2850
465	MJ-BC-4	20.19	1.85E+05	2.49E+03	245.9	beryl	LLNL	09/04/11	465MJ-BC-4	BE30833	2.286E-13	3.026E-15	1.038E-15	4.247E-16	2.276E-13	3.055E-15	07KNSTD	2850
465	DC-09-20	20.18	1.26E+06	2.21E+04	245.3	beryl	LLNL	09/04/11	465DC-09-20	BE30834	1.552E-12	2.716E-14	1.038E-15	4.247E-16	1.551E-12	2.716E-14	07KNSTD	2850
467	DC-03-06	14.99	2.52E+04	1.05E+03	244.9	beryl	LLNL	09/04/11	467DC-03-06	BE30855	2.408E-14	8.630E-16	1.038E-15	4.247E-16	2.304E-14	9.618E-16	07KNSTD	2850
467	DC-03-A2	20.06	5.09E+05	5.66E+03	246.8	beryl	LLNL	09/04/11	467DC-03-A2	BE30856	6.207E-13	6.871E-15	1.038E-15	4.247E-16	6.197E-13	6.884E-15	07KNSTD	2850
467	DC-04-45	20.13	2.08E+04	8.58E+02	245.9	beryl	LLNL	09/04/11	467DC-04-45	BE30857	2.657E-14	9.622E-16	1.038E-15	4.247E-16	2.553E-14	1.052E-15	07KNSTD	2850
467	DC-06-04	22.04	3.84E+05	5.61E+03	250.0	beryl	LLNL	09/04/11	467DC-06-04	BE30858	5.079E-13	7.391E-15	1.038E-15	4.247E-16	5.069E-13	7.403E-15	07KNSTD	2850
467	MJ-BC-12	21.44	1.29E+06	1.44E+04	254.0	beryl	LLNL	09/04/11	467MJ-BC-12	BE30860	1.635E-12	1.822E-14	1.038E-15	4.247E-16	1.634E-12	1.823E-14	07KNSTD	2850
467	MJ-BC-15	6.14	4.30E+05	1.80E+04	245.3	beryl	LLNL	09/04/11	467MJ-BC-15	BE30862	1.622E-13	6.729E-15	1.038E-15	4.247E-16	1.612E-13	6.742E-15	07KNSTD	2850
467	MJ-BC-17	20.13	1.13E+06	1.38E+04	245.9	beryl	LLNL	09/04/11	467MJ-BC-17	BE30863	1.383E-12	1.693E-14	1.038E-15	4.247E-16	1.382E-12	1.694E-14	07KNSTD	2850
491	COW113	20.01	4.88E+05	1.18E+04	255.6	beryl	SUERC	08/01/12	V491C113	b5592	5.728E-13	1.378E-14	1.038E-15	4.247E-16	5.717E-13	1.379E-14	NIST_27900	27900
491	COW114	20.08	2.94E+05	7.26E+03	256.0	beryl	SUERC	08/01/12	V491C114	b5594	3.465E-13	8.510E-15	1.038E-15	4.247E-16	3.455E-13	8.520E-15	NIST_27900	27900
491	COW115	20.58	3.14E+05	7.64E+03	256.2	beryl	SUERC	08/01/12	V491C115	b5595	3.786E-13	9.179E-15	1.038E-15	4.247E-16	3.776E-13	9.189E-15	NIST_27900	27900
493	COW102	7.81	3.54E+05	1.06E+04	253.7	beryl	SUERC	10/03/12	V493C102	b5705	1.643E-13	4.883E-15	1.038E-15	4.247E-16	1.633E-13	4.901E-15	NIST_27900	27900
493	COW103	18.70	2.36E+05	1.31E+04	257.0	beryl	SUERC	10/03/12	V493C103	b5706	2.578E-13	1.431E-14	1.038E-15	4.247E-16	2.568E-13	1.432E-14	NIST_27900	27900
493	COW116	21.14	2.37E+05	5.46E+03	255.3	beryl	SUERC	10/03/12	V493C116	b5708	2.943E-13	6.752E-15	1.038E-15	4.247E-16	2.933E-13	6.765E-15	NIST_27900	27900
493	COW117	19.71	3.56E+05	9.72E+03	255.5	beryl	SUERC	10/03/12	V493C117	b5709	4.121E-13	1.122E-14	1.038E-15	4.247E-16	4.110E-13	1.122E-14	NIST_27900	27900

Table DR3, Supplemental

Files SPEX BLANKS

date	sample	lab #	10/9 ratio	1 s unc	AMS standard	assumed value (10^-15)	carrier	AMS lab
04/25/02	224blank	BE15431	1.63E-14	1.80E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
04/25/02	225blank	BE15439	2.06E-14	2.23E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
04/26/02	229blank	BE15470	2.16E-14	2.50E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
06/27/03	260blank	BE18029	1.78E-14	1.33E-15	LLNL3000	3000	SPEX 1000 ppm	LLNL
08/29/03	263blank	BE18407	1.89E-14	1.50E-15	LLNL3000	3000	SPEX 1000 ppm	LLNL
02/28/04	265blank	BE18519	1.75E-14	7.01E-16	LLNL3000	3000	SPEX 1000 ppm	LLNL
08/29/03	266blank	BE18423	2.17E-14	2.13E-15	LLNL3000	3000	SPEX 1000 ppm	LLNL
07/29/04	285blank	BE19439	2.68E-14	4.78E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
07/29/04	286blank	BE19447	1.83E-14	1.84E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
07/29/04	287blank	BE19455	3.28E-14	3.23E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
07/29/04	288blank	BE19463	2.32E-14	1.72E-15	KNSTD	3153	SPEX 1000 ppm	LLNL
		average	2.141E-14	4.831E-15				
		median	2.062E-14					
		SD	4.831E-15					

BERYL BLANKS

date	sample	lab #	10/9 ratio	1 s unc	AMS standard	assumed value (10^-15)	carrier	AMS lab
09/04/11	462blank	BE30799	3.76E-16	2.57E-16	07KNSTD	2850	beryl	LLNL
06/10/11	465blank	BE30836	9.39E-16	3.00E-16	07KNSTD	2850	beryl	LLNL
09/04/11	467blank	BE30861	1.18E-15	2.90E-16	07KNSTD	2850	beryl	LLNL
08/01/12	491blank	b5591	1.17E-15	3.91E-16	NIST_27900	27900	beryl	SUERC
10/03/12	493blank	b5707	1.52E-15	7.62E-16	NIST_27900	27900	beryl	SUERC
		average	1.038E-15	4.247E-16				
		median	1.175E-15					
		SD	4.247E-16					

Table DR4, Supplemental Files

Sample	Batch	Al # LLNL	Measured 26/27		blank		Blank corrected 26/27		26Al (atoms/g)	
AL285 DPD-1	285	AL11482	9.13E-14	6.86E-15	3.77E-15	2.15E-15	8.75E-14	7.19E-15	1.63E+05 ±	1.43E+04
AL286 MJBC II	286	AL11484	2.38E-13	1.25E-14	3.77E-15	2.15E-15	2.34E-13	1.27E-14	2.59E+05 ±	1.73E+04
AL287 MJPRFL-3A	287	AL11486	2.30E-12	8.35E-14	3.77E-15	2.15E-15	2.29E-12	8.35E-14	1.56E+06 ±	8.46E+04
AL287 MJPRFL-3B	287	AL11487	1.45E-13	9.28E-15	3.77E-15	2.15E-15	1.41E-13	9.53E-15	1.91E+05 ±	1.54E+04
AL287 MJPRFL-3C	287	AL11488	1.87E-13	1.29E-14	3.77E-15	2.15E-15	1.84E-13	1.30E-14	1.42E+05 ±	1.18E+04
AL287 MJPRFL-3D	287	AL11489	4.95E-12	1.24E-13	3.77E-15	2.15E-15	4.95E-12	1.24E-13	5.97E+06 ±	2.82E+05
AL287 MJPRFL-3E	287	AL11490	1.86E-13	1.44E-14	3.77E-15	2.15E-15	1.82E-13	1.46E-14	2.28E+05 ±	2.07E+04
AL287 MJPRFL-3F	287	AL11491	1.62E-13	7.12E-15	3.77E-15	2.15E-15	1.58E-13	7.44E-15	1.58E+05 ±	1.01E+04
AL289 MJPRFL-3G	287	AL11493	9.91E-14	7.70E-15	3.77E-15	2.15E-15	9.53E-14	7.99E-15	1.37E+05 ±	1.44E+04

Sample measurements normalized to KNSTD10650

BLANKS (26Al)

AL285 BLANK		AL11481	2.01E-15	1.01E-15			2.01E-15	1.01E-15
AL286 BLANK		AL11483	1.80E-15	1.57E-15			1.80E-15	1.57E-15
AL287 BLANK		AL11485	5.61E-15	3.08E-15			5.61E-15	3.08E-15
AL289 BLANK		AL11492	5.64E-15	4.88E-15			5.64E-15	4.88E-15
						average	3.77E-15	
						median	3.81E-15	
						SD	2.15E-15	