GSA Data Repository Item 2001127, Table DR1, Helium data for Eightmile terminal moraines, and Table DR2, Beryllium data for Yellowstone moraines.

Table DR1. Helium data for Eightmile terminal moraines. Duplicate ^{3}He measurements on splits of olivine from the same boulder, prepared separately for analysis, are labeled 8B-1A and 8B-1B, etc. Olivine compositions (expressed as forsterite content) are mean values and sample standard deviations derived from individual electron microprobe measurements on at least five phenocrysts from each sample location. The narrow range of compositions exhibited by the analyzed olivine phenocrysts (from Fo_{77} to Fo_{83}) suggests that compositional differences are an unlikely source of scatter in the ^{3}He ages (cf. Lal, 1991). Helium measurement uncertainties are based on 0.5% uncertainty on the ^{4}He peak and an error of 2×10^{-12} cm^3 STP (about 3%) on the blank. We do not correct for implantation of radiogenic ^{4}He (cf. Brook et al., 1995; Kurz et al, 1996; Dunai and Wijbrans, 2000) in our calculations, and we assume the potential effects to be within the range of measurement uncertainty. $^3He/^4He$ ratios are reported relative to the atmospheric value (R/R_a, where $R_a = 1.384 \times 10^{-6}$). For all samples, crushing and melting were performed on the same mineral separate. Crushed ^{4}He contents were relatively low (7.4×10^{-11} to 5.4×10^{-10} cm^3 STP), leading to significant blank corrections for some of the inherited $^3He/^4He$ ratios (blank values ranged from 4.7 to 6.6×10^{-11} cm^3 STP). The large blank corrections for the inherited ^{4}He, however, contribute minimal error to the calculated ^{3}He ages because of the comparatively large amounts of cosmogenic ^{3}He and the high reproducibility of the blanks. Weighted means of duplicate measurements of inherited $^3He/^4He$ ratios were used for age calculations. "#" indicates ^3He_c concentrations normalized to the surface. Thickness corrections assume an attenuation coefficient of 170 $g \cdot cm^{-2}$ (Kurz, 1986) and a rock density of 3.1 $g \cdot cm^{-3}$. Scaling factors are the ratio of production at sample location to production at high latitudes at sea level, following Lal (1991, table 2). All quoted uncertainties are 1σ, and incorporate analytical error only. The magnitude of additional uncertainties is discussed in the text.

Table DR1. Helium data for Eightmile terminal moraines.

Sample	Olivine (g)	Oliv. Comp.	Thickness (cm)	Alt. (km)	Lat. (deg. N)	Lon. (deg. W)	$^{3}He/^{4}He$ (R/R_a, crush)	$^{3}He/^{4}He$ (R/R_a, melt)	^{4}He (10^{-9} cm^3 g^{-1})	$^{3}He_c$ (10^5 at g^{-1})	$^{3}He_c$# (10^5 at g^{-1})	Scaling factor	Age (^{3}He ka)
8B-1A	0.287	$Fo_{77±5}$	2.00	1.529	45.436	110.690	17.79 ± 2.66	97.97 ± 0.58	2.10 ± 0.01	60.14 ± 2.59	61.24 ± 2.63	3.56	14.5 ± 0.6
8B-1B	0.206	$Fo_{77±5}$	2.00	1.529	45.436	110.690	24.22 ± 2.80	92.57 ± 0.64	2.23 ± 0.01	59.40 ± 2.76	60.49 ± 2.81	3.56	14.3 ± 0.7
8B-2	0.285	$Fo_{82±1}$	2.50	1.529	45.436	110.690	18.66 ± 0.37	96.31 ± 0.60	2.31 ± 0.01	66.64 ± 0.78	68.18 ± 0.80	3.56	16.2 ± 0.2
8B-3	0.291	$Fo_{81±1}$	2.50	1.529	45.436	110.690	17.89 ± 0.58	133.73 ± 0.79	1.62 ± 0.01	69.81 ± 0.80	71.42 ± 0.82	3.56	16.9 ± 0.2
8B-4A	0.229	$Fo_{82±2}$	2.25	1.538	45.436	110.693	21.19 ± 2.36	110.67 ± 0.81	2.10 ± 0.01	70.09 ± 0.90	71.53 ± 0.92	3.58	16.8 ± 0.2
8B-4B	0.327	$Fo_{82±2}$	2.25	1.538	45.436	110.693	21.17 ± 0.36	77.04 ± 0.30	3.03 ± 0.02	63.10 ± 0.72	64.40 ± 0.73	3.58	15.2 ± 0.2
8B-5	0.134	$Fo_{83±2}$	3.00	1.541	45.434	110.692	18.54 ± 3.06	73.51 ± 0.51	3.49 ± 0.02	71.49 ± 4.09	73.46 ± 4.20	3.59	17.3 ± 1.0
8B-6	0.147	$Fo_{83±1}$	2.50	1.529	45.435	110.688	10.04 ± 0.28	51.65 ± 0.44	4.24 ± 0.03	65.61 ± 0.96	67.12 ± 0.98	3.56	15.9 ± 0.2
8B-7A	0.263	$Fo_{79±3}$	3.00	1.530	45.436	110.686	4.56 ± 0.35	185.49 ± 1.14	1.15 ± 0.01	77.56 ± 0.83	79.70 ± 0.85	3.56	18.9 ± 0.2
8B-7B	0.224	$Fo_{79±3}$	3.00	1.530	45.436	110.686	4.08 ± 0.40	119.03 ± 0.90	1.76 ± 0.01	75.26 ± 0.83	77.33 ± 0.85	3.56	18.3 ± 0.2
8B-8A	0.275	$Fo_{81±1}$	1.50	1.530	45.436	110.687	16.70 ± 1.06	135.28 ± 1.01	1.64 ± 0.01	72.50 ± 0.94	73.49 ± 0.95	3.56	17.4 ± 0.2
8B-8B	0.287	$Fo_{81±1}$	1.50	1.530	45.436	110.687	16.67 ± 0.95	120.69 ± 0.73	1.79 ± 0.00	69.27 ± 0.85	70.22 ± 0.86	3.56	16.6 ± 0.2

Table DR2. Beryllium data for Yellowstone moraines. Duplicate ^{10}Be measurements on splits of quartz from the same boulder, prepared separately for analysis, are labeled 8-J1 and 8-J2, CH-6A and CH-6B, etc. The ^{10}Be data are normalized with respect to a standard reference material (SRM 4325) obtained from the National Institute of Standards and Technology, and a correction was incorporated for the discrepancy of 14% reported by Middleton et al. (1993) for SRM 4325 (cf. Sharma et al., 2000). The largest potential contributor to analytical uncertainty of the ^{10}Be measurements is isobaric interference of ^{10}B with ^{10}Be. We rejected all measurements with high boron interference, thereby minimizing uncertainties imparted by this effect. The precision of the ^{10}Be measurements is dependent in part on the degree of isobaric ^{10}B interference and on the counting time and ^{10}Be activity level. Because these parameters varied widely among the samples, so does the associated measurement precision. Analyses of 13 chemical blanks yielded $^{10}Be/^{9}Be$ ratios that range from 0.5 to 7.8×10^{-15} and have a mean value of 3.2×10^{-15}, which is comparable to the $^{10}Be/^{9}Be$ background level of the accelerator mass spectrometer at the PRIME Lab facility (Sharma et al., 2000). These results indicate that laboratory contamination with meteoric ^{10}Be is not a problem for our samples. "#" indicates cosmogenic ^{10}Be concentrations normalized to the surface. Thickness corrections assume an attenuation coefficient of 145 $g \cdot cm^{-2}$ (Brown et al., 1992) and a rock density of 2.8 $g \cdot cm^{-3}$. Scaling factors are the ratio of production at sample locations to production at high latitudes at sea level, following Stone (2000). All quoted uncertainties are 1σ, and incorporate analytical error only. The magnitude of additional uncertainties is discussed in the text.

Table DR2. Beryllium data for Yellowstone moraines.

Sample	Quartz (g)	Thickness (cm)	Altitude (km)	Latitude (deg. N)	Longitude (deg. W)	^{10}Be (10^5 at g^{-1})	^{10}Be# (10^5 at g^{-1})	Scaling factor	Age (^{10}Be ka)
Eightmile Terminal Moraines									
8-A2	40.011	1.00	1.548	45.432	110.700	2.21 ± 0.17	2.23 ± 0.17	3.57	12.3 ± 0.9
8-B2	21.874	2.50	1.550	45.429	110.707	2.59 ± 0.29	2.66 ± 0.29	3.57	14.6 ± 1.6
8-D1	29.049	0.75	1.545	45.429	110.705	2.83 ± 0.16	2.85 ± 0.16	3.56	15.7 ± 0.9
8-F2	18.841	1.50	1.544	45.437	110.695	3.08 ± 0.28	3.13 ± 0.29	3.56	17.3 ± 1.6
8-G2	21.504	1.00	1.529	45.436	110.691	3.34 ± 0.28	3.38 ± 0.28	3.52	18.9 ± 1.6
8-I1	30.089	1.75	1.529	45.435	110.690	2.82 ± 0.14	2.86 ± 0.14	3.52	16.0 ± 0.8
8-I2	21.839	1.75	1.529	45.435	110.690	3.00 ± 0.26	3.05 ± 0.27	3.52	17.1 ± 1.5
8-J1	28.108	2.00	1.554	45.365	110.690	2.81 ± 0.38	2.86 ± 0.39	3.58	15.7 ± 2.2
8-J2	20.938	2.00	1.554	45.365	110.690	3.10 ± 0.33	3.16 ± 0.34	3.58	17.3 ± 1.9
8-K1	30.238	2.75	1.536	45.429	110.688	2.91 ± 0.10	2.99 ± 0.10	3.54	16.6 ± 0.5
8-L1	21.229	3.00	1.554	45.365	110.690	2.22 ± 0.23	2.29 ± 0.24	3.58	12.5 ± 1.3
8-L2	20.713	3.00	1.554	45.365	110.690	2.89 ± 0.14	2.98 ± 0.14	3.58	16.4 ± 0.8
8-M2	19.915	2.50	1.561	45.363	110.691	2.80 ± 0.11	2.87 ± 0.11	3.60	15.7 ± 0.6
Chico Moraines									
CH-1A	30.003	2.50	1.628	45.339	110.698	2.64 ± 0.22	2.70 ± 0.23	3.78	14.1 ± 1.2
CH-2A	32.923	1.75	1.634	45.337	110.697	2.90 ± 0.18	2.95 ± 0.18	3.80	15.3 ± 0.9
CH-3B	25.857	1.75	1.652	45.334	110.695	2.98 ± 0.26	3.03 ± 0.26	3.85	15.5 ± 1.3
CH-6A	37.241	1.75	1.615	45.335	110.705	2.64 ± 0.22	2.69 ± 0.22	3.75	14.1 ± 1.2
CH-6B	30.022	1.75	1.615	45.335	110.705	2.48 ± 0.27	2.52 ± 0.27	3.75	13.2 ± 1.4
CH-8A	24.371	0.75	1.615	45.336	110.704	3.27 ± 0.19	3.29 ± 0.19	3.75	17.3 ± 1.0
CH-9B	21.511	1.75	1.618	45.338	110.703	3.10 ± 0.21	3.15 ± 0.22	3.75	16.5 ± 1.1
CH-10B	28.763	1.25	1.612	45.340	110.703	3.47 ± 0.20	3.52 ± 0.21	3.74	18.5 ± 1.1
CH-11B	25.669	0.75	1.615	45.342	110.703	2.97 ± 0.14	2.99 ± 0.14	3.75	15.7 ± 0.7
Deckard Flats Moraines									
DF-1A	40.079	0.75	1.811	45.039	110.685	2.99 ± 0.13	3.01 ± 0.14	4.30	13.8 ± 0.6
DF-2B	32.035	1.75	1.811	45.039	110.685	2.71 ± 0.25	2.75 ± 0.25	4.30	12.6 ± 1.1
DF-3B	18.359	1.75	1.811	45.039	110.685	2.83 ± 0.19	2.88 ± 0.19	4.30	13.2 ± 0.9
DF-4A	25.067	1.75	1.811	45.039	110.685	2.67 ± 0.23	2.71 ± 0.23	4.30	12.4 ± 1.1
DF-5B	24.667	1.50	1.811	45.039	110.685	3.45 ± 0.14	3.50 ± 0.14	4.30	16.0 ± 0.7
DF-6A	25.124	1.75	1.811	45.039	110.685	2.88 ± 0.15	2.93 ± 0.15	4.30	13.4 ± 0.7
DF-6B	24.725	1.75	1.811	45.039	110.685	3.19 ± 0.24	3.25 ± 0.25	4.30	14.9 ± 1.1
DF-7A	40.038	1.50	1.811	45.039	110.685	3.07 ± 0.16	3.11 ± 0.16	4.30	14.2 ± 0.7
DF-8A	24.807	1.25	1.807	45.038	110.685	3.23 ± 0.19	3.26 ± 0.19	4.29	15.0 ± 0.9
DF-9B	30.054	1.75	1.804	45.038	110.684	2.81 ± 0.11	2.86 ± 0.11	4.28	13.1 ± 0.5
DF-10A	24.299	0.75	1.801	45.038	110.683	3.22 ± 0.39	3.24 ± 0.39	4.27	14.9 ± 1.8
Flood Deposit									
F-1A	22.024	0.50	1.583	45.056	110.764	3.07 ± 0.33	3.09 ± 0.34	3.64	16.7 ± 1.8
F-3A	25.013	1.50	1.583	45.056	110.764	2.25 ± 0.14	2.28 ± 0.15	3.64	12.3 ± 0.8
F-3B	24.146	1.50	1.583	45.056	110.764	2.46 ± 0.13	2.50 ± 0.13	3.64	13.5 ± 0.7
F-4A	25.015	0.50	1.584	45.056	110.764	2.21 ± 0.29	2.22 ± 0.29	3.64	12.0 ± 1.6
F-6A	25.012	1.50	1.584	45.056	110.764	2.30 ± 0.13	2.33 ± 0.13	3.64	12.6 ± 0.7
F-6B	24.171	1.50	1.584	45.056	110.764	2.57 ± 0.14	2.61 ± 0.14	3.64	14.1 ± 0.7
F-9A	26.856	2.00	1.585	45.057	110.764	2.72 ± 0.14	2.78 ± 0.14	3.65	15.0 ± 0.8
F-9B	25.203	2.00	1.585	45.057	110.764	2.79 ± 0.14	2.84 ± 0.15	3.65	15.3 ± 0.8
F-10B	40.138	1.50	1.585	45.057	110.764	2.45 ± 0.17	2.49 ± 0.18	3.65	13.4 ± 1.0
F-11A	25.020	1.50	1.584	45.056	110.764	2.19 ± 0.23	2.20 ± 0.23	3.64	11.9 ± 1.2

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