Supplementary Table 1: Cosmogenic ^{21}Ne results from Vernon boulder deposit (Henry's Fork Flood)

ID	Lat. (wgs 84)	Lon. (wgs 84)	Elev (m)	Thick (cm)	Shield (Mat/g)	$^{20}Ne_m$ (Mat/g)	1σ (Mat/g)	$^{21}Ne_m$ (Mat/g)	1σ unitless	$^{22}Ne_m$ (kyr)	1σ (kyr)	$^{21}Ne_x$ (Mat/g)	1σ (Mat/g)	Scale	Age (kyr)	1σ (kyr)
Shielded Sample																
ID10-15	44.0558909	-111.528617	1565	-	-	2387.3	6.6	7.1	0.2	243.2	2	0.07	0.17	-	-	-
Boulders																
ID10-10	44.0520488	-111.539495	1555	2	1	1296	5.3	5	0.2	132.8	1.9	1.2	0.15	3.52	18.1	0.5
ID10-11	44.0520469	-111.539471	1556	2.5	1	2153.5	7.3	6.9	0.2	219.8	2.2	0.57	0.19	3.52	8.6	1.2
ID10-12	44.0501758	-111.539909	1556	3	1	746.3	4.7	2.9	0.1	76.6	1.6	0.68	0.13	3.52	10.4	0.7
ID10-13	44.0501472	-111.540498	1558	3	1	2374.5	6.2	7.6	0.2	245.7	2	0.6	0.17	3.5	9.2	1
ID12-14	44.0501975	-111.539537	1551	3.5	1	1324.9	5.2	4.5	0.2	138.1	1.8	0.55	0.16	3.54	8.3	1
ID12-17	44.051868	-111.539941	1557	3	1	867.9	4.7	3.2	0.1	89	1.8	0.65	0.15	3.53	9.8	0.8

Supplementary Table 2: Cosmogenic ^{3}He results from Big Lost River Scablands

ID	Lat. (wgs 84)	Lon. (wgs 84)	Elev (m)	Thick (cm)	Shield (Mat/g)	^3He_m (Mat/g)	1σ (Mat/g)	^4He_m (Tat/g)	1σ (Tat/g)	$^3He/^4He$ Ra	$^3He_{cor}$ (Mat/g)	1σ (Mat/g)	Scale factor	Age (kyr)	1σ (kyr)
Shielded Samples															
ID10-29	2.24	0.13	0.04	0		2.24	0.13	0.04	0						
Boulders From Bone Cataract															
ID11-07	43.53127	-113.18115	1574	3	1	11.06	0.46	0.05	0	159	8.8	0.48	3.55	21.8	2.3
ID11-06	43.53132	-113.1812	1571	3	1	11.07	0.44	0.02	0	492	8.8	0.45	3.54	21.9	2.2
ID11-08	43.53121	-113.18115	1573	2	1	11.2	0.44	0.12	0	67	9	0.46	3.55	22.1	2.2
ID10-22	43.53145	-113.18037	1571	3	1	12.13	0.44	0.04	0	226	9.9	0.46	3.55	24.4	2.4
ID10-27	43.53114	-113.18098	1576	3	1	13.27	0.47	0.02	0	596	11	0.49	3.58	27	2.5
ID10-23	43.53126	-113.18071	1575	3	1	17.32	0.51	0.03	0	405	15.1	0.52	3.61	36.6	3.1
ID10-24	43.53082	-113.18024	1575	3	1	21.5	0.83	0.34	0.01	45	19.3	0.84	3.64	46.4	4.4
ID10-26	43.53119	-113.18135	1575	3	1	36.04	1.11	0.06	0	408	33.8	1.12	3.61	82	6.8
ID10-21	43.5313	-113.18027	1571	3	1	51.43	1.54	0.12	0	312	49.2	1.55	3.59	120.2	9.8
Boulders From Lost Moon Cataract															
ID11-09					1	11.15	0.48	2.11	0.05	4	8.9	0.49	3.55	22	2.3
ID11-18	43.53335	-113.18907	1576	3	1	11.57	0.42	0.05	0	156	9.3	0.44	3.56	23	2.2
ID11-16	43.53302	-113.18884	1576	3	1	11.7	0.44	0.05	0	163	9.5	0.46	3.56	23.3	2.3
ID11-12	43.53287	-113.18905	1575	3	1	12.46	0.47	0.06	0	152	10.2	0.48	3.57	25.1	2.4
ID11-17	43.53274	-113.18924	1575	3	1	12.65	0.52	0.07	0	131	10.4	0.53	3.57	25.6	2.6
ID11-11	43.53314	-113.18973	1577	3	1	13.91	0.51	0.09	0	112	11.7	0.53	3.58	28.6	2.7
ID11-14	43.53276	-113.18947	1576	3	1	14.65	0.55	0.49	0.01	22	12.4	0.56	3.59	30.3	2.9
ID11-13	43.5328	-113.18976	1575	3	1	15.79	0.57	0.17	0	66	13.5	0.59	3.6	33	3.1
ID11-10	43.5334	-113.1898	1576	3	1	16.67	0.48	0.01	0	2233	14.4	0.5	3.61	35.1	3
ID11-20	43.53337	-113.18963	1574	3	1	40.2	1.3	0.48	0.01	61	38	1.31	3.61	92.4	7.8

Supplementary Table 3: Cosmogenic ^{3}He results from the Inkom site

ID	Lat. (wgs 84)	Lon. (wgs 84)	Elev (m)	Thick (cm)	Shield (Mat/g)	$^{3}He_{m}$ (Mat/g)	1σ (Mat/g)	$^{4}He_{m}$ (Tat/g)	1σ (Tat/g)	$^{3}He/^{4}He$ Ra	$^{3}He_{cor}$ (Mat/g)	1σ (Mat/g)	Scale factor	Age (kyr)	1σ (kyr)
Shielded Samples															
ID12-12b	42.762198	-112.23001	1395			0.45	0.02	0.66	0.02	0.5	-	-	-	-	-
Flood-Deposited Boulders															
ID11-87	42.79439	-112.23198	1424	3	1	6.72	0.02	0.02	41.37	202	6.27	0.03	3.11	17.7	1
ID11-88	42.79444	-112.23199	1423	3	1	6.58	0.16	0.16	40.51	30	6.13	0.16	3.11	17.3	1.3
ID11-89	42.79448	-112.2321	1422	3	1	6.63	0.06	0.06	40.8	82	6.18	0.06	3.11	17.4	1.1
ID11-90	42.79446	-112.2322	1424	3	1	6.74	0.03	0.03	41.51	158	6.3	0.04	3.11	17.7	1
ID11-91	42.79449	-112.23221	1425	3	1	6.63	0.06	0.06	40.82	76	6.18	0.07	3.11	17.4	1.1
												Mean age:		**17.5**	**0.2**

Supplementary Table 4: Cosmogenic ^{3}He results from Devil'a Corral

ID	Lat. (wgs 84)	Lon. (wgs 84)	Elev (m)	Thick (cm)	Shield (Mat/g)	^3He_m (Mat/g)	1σ (Mat/g)	^4He_m (Tat/g)	1σ (Tat/g)	$^3He/^4He$ Ra	$^3He_{cor}$ (Mat/g)	1σ (Mat/g)	Scale factor	Age (kyr)	1σ (kyr)
Shielded Samples															
ID11-40sh	0.18	0.01	0.14	-	-	0.18	0.01	0.14	0	1					
Plunge Pool (PP)															
ID11-55	42.5961	-114.36	1134	3	1	5.28	0.19	0.07	0	51	5.1	0.2	2.5	17.9	1.6
ID11-56	42.59608	-114.36	1134	3	1	5.1	0.18	0.03	0	107	4.9	0.2	2.5	17.3	1.5
ID11-57	42.59604	-114.36	1134	3	1	5.2	0.19	0.04	0	106	5	0.2	2.5	17.6	1.6
ID11-58	42.59603	-114.36	1132	2	1	5.22	0.18	0.09	0	42	5	0.2	2.49	17.7	1.5
ID11-59	42.59599	-114.36	1134	2	1	5.39	0.18	0.07	0	59	5.2	0.2	2.5	18.3	1.6
ID11-60	42.596	-114.36	1133	3	1	5.12	0.23	0.06	0	64	4.9	0.2	2.49	17.4	1.7
ID11-61	42.59599	-114.36	1134	3	1	5.1	0.23	0.03	0	126	4.9	0.2	2.5	17.3	1.7
ID11-62	42.59598	-114.36	1133	3	1	5.16	0.18	0.06	0	64	5	0.2	2.49	17.5	1.5
												Mean Age:		**17.6**	**0.4**
High Spire (HS)															
ID11-67	42.60255	-114.363	1142	3	1	5.48	0.27	0.26	0.01	15	5.3	0.3	2.51	18.5	1.9
ID11-68	42.6026	-114.363	1143	2	1	5.53	0.18	0.1	0	41	5.3	0.2	2.52	18.6	1.6
ID11-69	42.60269	-114.362	1141	3	1	5.06	0.2	0.45	0.01	8	4.9	0.2	2.51	17	1.5
ID11-70	42.60273	-114.362	1144	3	1	5.23	0.23	0.03	0	143	5.1	0.2	2.52	17.6	1.7
ID11-71	42.60262	-114.362	1141	2	1	5.07	0.23	0.06	0	64	4.9	0.2	2.51	17.1	1.7
ID11-72	42.60262	-114.362	1142	2	1	5.44	0.18	0.03	0	132	5.3	0.2	2.51	18.3	1.6
ID11-73	42.6026	-114.363	1142	2	1	5.61	0.26	0.04	0	104	5.4	0.3	2.52	18.9	1.9
ID11-74	42.60258	-114.362	1141	3	1	5.27	0.18	0.07	0	57	5.1	0.2	2.51	17.8	1.5
												Mean Age:		**18**	**0.7**
Upper Lobe A (ULA)															
ID11-41	42.60635	-114.357	1138	3	1	5.19	0.19	0.49	0.01	8	5	0.2	2.5	17.5	1.5
ID11-42	42.60676	-114.357	1138	3	1	5.51	0.2	0.23	0.01	17	5.3	0.2	2.51	18.6	1.6
ID11-43	42.60636	-114.357	1137	3	1	5.67	0.19	0.04	0	96	5.5	0.2	2.51	19.2	1.6
ID11-44	42.60633	-114.357	1136	4	1	5.26	0.18	0.13	0	30	5.1	0.2	2.5	17.8	1.5
ID11-45	42.60636	-114.357	1135	3	1	5.31	0.2	0.09	0	41	5.1	0.2	2.5	18	1.6
												Mean Age:		**18.2**	**0.8**
High Plateau (HP)															
ID11-31	42.59604	-114.361	1130	3	1	5.52	0.25	0.07	0	60	5.3	0.2	2.49	18.8	1.8
ID11-32	42.59598	-114.361	1132	3	1	5.33	0.18	0.19	0.01	20	5.1	0.2	2.49	18.1	1.5
ID11-33	42.59588	-114.361	1130	4	1	5.26	0.26	0.47	0.01	8	5.1	0.3	2.49	17.9	1.8
ID11-34	42.60663	-114.362	1157	3	1	5.86	0.29	0.24	0.01	17	5.7	0.3	2.55	19.5	2
ID11-35	42.60541	-114.356	1148	2	1	6.16	0.22	0.14	0	31	6	0.2	2.53	20.7	1.8
ID11-36	42.60553	-114.358	1142	3	1	5.39	0.19	0.13	0	30	5.2	0.2	2.51	18.2	1.6
ID11-37	42.59595	-114.361	1133	3	1	5.34	0.18	0.03	0	115	5.2	0.2	2.5	18.1	1.5
ID11-38	42.60646	-114.361	1151	3	1	5.5	0.2	0.08	0	47	5.3	0.2	2.52	18.5	1.6
												Mean Age:		**18.7**	**1**
Lower Canyon (LC)															
ID10-75	42.60042	-114.3674	1091	3	1	6.16	0.31	0.3	0.08	15	6	0.3	2.43	21.6	2.2
ID10-76	42.60042	-114.3674	1089	3	1	6.05	0.3	0.59	0.15	7	5.9	0.3	2.41	21.3	2.2
ID10-77	42.60058	-114.3675	1094	3	1	5.95	0.3	1.77	0.34	2	5.8	0.3	2.43	20.8	2.1
														21.2	**0.4**
Lower Lobe A (LLA)															
ID11-46	42.60656	-114.357	1138	3	1	6.14	0.3	1.43	0.04	3	6	0.3	2.51	20.8	2.1
ID11-47	42.60638	-114.358	1132	3	1	6.7	0.26	0.03	0	182	6.5	0.3	2.51	22.8	2
ID11-48	42.6063	-114.358	1132	3	1	6.11	0.27	0.04	0	125	5.9	0.3	2.49	20.9	2
												Mean Age:		**21.5**	**1.1**
Talus Amphitheater (TA)															
ID11-49	42.59967	-114.365	1101	3	0.91	3.69	0.13	0.08	0	34	3.5	0.1	2.22	13.9	1.2
ID11-50	42.59962	-114.365	1100	2	0.91	4.96	0.23	0.13	0	28	4.8	0.2	2.22	18.9	1.8
ID11-51	42.59963	-114.365	1115	3	0.91	3.52	0.22	0.52	0.01	5	3.3	0.2	2.25	13	1.5
ID11-52	42.59934	-114.365	1114	3	0.89	3.01	0.11	0.02	0	94	2.8	0.1	2.2	11.3	1
ID11-53	42.59933	-114.365	1103	3	0.89	1.35	0.06	0.16	0	6	1.2	0.1	2.09	4.9	0.5
ID11-54	42.59914	-114.365	1109	3	0.93	0.97	0.04	0.05	0	13	0.8	0	2.18	3.2	0.3

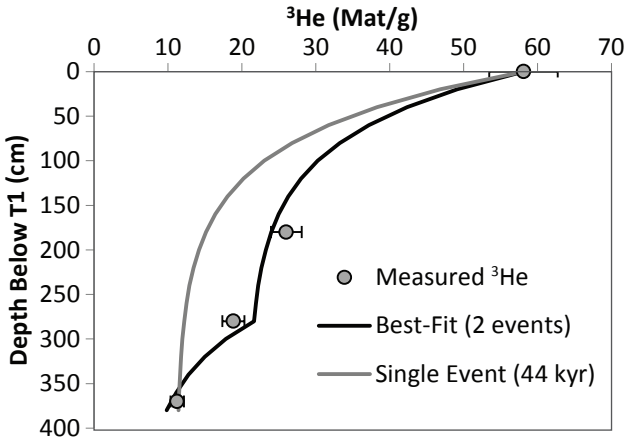
Supplementary Table 5: Cosmogenic ^{3}He results from Blue Lakes Canyon

ID	Lat. (wgs 84)	Lon. (wgs 84)	Elev (m)	Thick (cm)	Shield (Mat/g)	$^{3}He_{m}$ (Mat/g)	1σ (Mat/g)	$^{4}He_{m}$ (Tat/g)	1σ (Tat/g)	$^{3}He/^{4}He$ Ra	$^{3}He_{cor}$ (Mat/g)	1σ (Mat/g)	Scale factor	Age (kyr)	1σ (kyr)
Shielded Samples															
ID10-45sh	42.61213	-114.4664	1097			0.21	0.05	0	0	3.2	-	-	-	-	-
Flood-deposited Boulder															
ID10-40	42.61255	-114.466	1083	3	1	6.3	0.03	0.03	0	163.8	6.1	0.06	2.41	22	1.3
ID10-41	42.61247	-114.4659	1084	2	1	6.3	0.05	0.05	0	100.9	6.1	0.07	2.41	22.2	1.4
ID10-42	42.61247	-114.4658	1087	3	1	5.7	0.1	0.15	0	27.5	5.5	0.16	2.41	19.8	1.6
ID10-43	42.61278	-114.4665	1086	3	1	6	0.1	0.06	0	72.3	5.8	0.08	2.41	20.9	1.3
ID10-44	42.61243	-114.4661	1086	2	1	5.74	0.08	0.08	0	54.3	5.5	0.09	2.41	20.1	1.3
Talus Boulders															
ID10-45	42.61202	-114.4654	1091	3	0.99	1.7	0	4.19	0.3	0.3	1.5	0.06	2.33	5.8	0.5
ID10-46	42.6121	-114.4648	1080	4	0.99	5.7	0.1	1.13	3.6	3.6	5.5	0.08	2.31	20.8	1.3
ID10-47	42.61224	-114.4652	1077	3	0.99	1.8	0.1	0.2	6.5	6.5	1.6	0.07	2.31	6.2	0.6
ID10-48	42.612449	-114.464810	1004	3	0.99	1.4	0	0.61	1.7	1.7	1.2	0.05	2.16	4.9	0.5
												Mean Age:		**21**	**1**

Supplementary Table 6: Cosmogenic ^{3}He results from Box Canyon

ID	Lat. (wgs 84)	Lon. (wgs 84)	Elev (m)	Thick (cm)	Shield (Mat/g)	^3He_m (Mat/g)	1σ (Mat/g)	^4He_m (Tat/g)	1σ (Tat/g)	$^3He/^4He$ Ra	$^3He_{cor}$ (Mat/g)	1σ (Mat/g)	Scale factor	Age (kyr)	1σ (kyr)
Shielded Samples															
04ABC5*	42.70544	-114.819	947			0.12	1.12	0.02	1.02	4	-	-	-	-	-
Eroded Bedorck Surfaces															
04ABC4*	42.70833	-114.803	970	3	1	10.8	2.91	0.02	2.24	312	10.66	3.12	2.25	41.6	14.2
ID10-50(S4)	42.70843	-114.803	966	3	1	11.4	0.45	5.27	1.05	2	11.24	1.21	2.25	43.9	6.9
ID10-51(S3)	42.7083	-114.803	967	3	1	19	0.95	0.06	0.02	225	18.85	1.47	2.24	73.8	9.4
ID10-52(S2)	42.70821	-114.803	968	3	1	26.1	1.04	0.07	0.01	268	26	1.53	2.24	101.8	11.1
ID10-53(S1)	42.7081	-114.802	969	3	1	58.2	1.75	0.59	0.15	71	58.11	2.08	2.24	227.6	19.5
ID10-54	42.70876	-114.803	972	3	1	38.2	1.34	0.05	0.02	607	38.07	1.74	2.24	148.8	14.3
ID10-49	42.70843	-114.803	1001	3	1	18.5	0.92	0.05	0.01	252	18.34	1.45	2.29	70.3	9.1
Flood-deposited Boulders															
04ABC3*	42.70796	-114.805	922	3	0.95	4.5	1.2	0.02	1.83	158	4.34	1.64	2.02	19.8	8.5
04ABC1*	42.70724	-114.821	864	3	0.97	4.5	1.22	0.02	1.02	216	4.4	1.65	1.97	20.1	8.6
ID12-8	42.70782	-114.812	928	3	0.97	4.9	0.2	0.2	0.01	17	4.81	1.14	2.07	20.9	6
ID12-7	42.70786	-114.812	930	3	0.97	5.4	0.22	0.46	0.01	8	5.24	1.14	2.08	22.7	6.1
ID12-9	42.7078	-114.812	929	3	0.97	8.8	0.32	0.27	0.01	23	8.64	1.16	2.1	37.1	6.9
04ABC2*	42.70784	-114.813	886	3	0.97	10.7	2.89	0.05	4.46	156	10.6	3.1	2.05	46.9	16.1
04ABC2-2*	42.70784	-114.813	886	3	0.97	11.1	3.01	0.53	47.69	15	11.02	3.21	2.05	48.7	16.6
												Preferred Age:		**20.9**	**1.3**

*Denotes data rescaled from Aciego et al. 2008☐
Samples 04ABC4 and ID10-50 are both from base of spillway. Samples ID10-51,52, and 53 are from si
Sample ID10-54 is from the top of the Bacon Butte lava flow.☐
Sample ID10-49 is from a fluvially scoured bedrock channel upstream of Box Canyon (see figure 5)



Amidon
Supp. Figure 1