

Table DR1. $^{40}\text{Ar}/^{39}\text{Ar}$ ages for Eocene strata and magmatism in the Laramide foreland province

Location Sample	Stratigraphy	Dated Material	Method	flux monitor	Age (Ma)	$\pm 2\sigma^\dagger$	$\pm 2\sigma^\ddagger$	References
Greater Green River Basin								
Scheggs tuff	Tipton Member	san	fus	TCs	52.22	0.09	0.35	Smith et al. (2008;2010)
Rife tuff	"	san	fus		51.62	0.30	0.45	
Firehole tuff	Wilkins Peak Member	san	fus		51.41	0.21	0.39	
Boar tuff	"	san	fus		51.14	0.24	0.41	
Grey tuff	"	san	fus		50.86	0.21	0.39	
Main tuff	"	san	fus		50.28	0.09	0.34	
Layered tuff	"	san	fus		50.12	0.09	0.34	
6th tuff	"	bio	ih		49.93	0.10	0.34	
Analcite tuff	Laney Member	san	fus		49.25	0.12	0.34	
Antelope sandstone	"	san	fus		49.00	0.19	0.37	
Church Butte tuff	Bridger Formation	san	fus		49.06	0.09	0.33	
Leavitt Creek tuff	"	san	fus		48.93	0.28	0.42	
Henrys Fork tuff	"	san	fus		48.45	0.08	0.32	
Tabernacle Butte tuff	"	san	fus		48.41	0.08	0.32	
Sage Creek tuff	"	san	fus		47.46	0.08	0.32	
Continental tuff	"	san	fus		48.97	0.28	0.42	
K-spar tuff	Fossil Butte Member	san	fus		51.98	0.09	0.35	
Sage tuff	Fowkes Formation	san	fus		48.23	0.17	0.36	
Piceance Creek Basin								
Yellow tuff	Parachute Creek Mb.	san	fus		51.56	0.52	0.62	
Uinta Basin								
Curly tuff	Parachute Creek Mb.	bio	ih		49.32	0.30	0.44	
Wavy tuff	"	bio	ih		48.67	0.23	0.39	
Blind Canyon tuff	"	bio	ih		47.33	0.18	0.36	
Fat tuff	saline member	bio	ih		46.63	0.13	0.33	
Portly tuff	"	bio	ih		45.86	0.14	0.33	
Oily tuff	"	bio	ih		45.42	0.10	0.31	
Strawberry tuff	sandstone and limestone member	san	fus		44.27	0.93	0.97	
Wind River Basin								
Halfway Draw tuff	Wind River Formation	san	fus		52.07	0.10	0.35	
Wagon Bed tuff	Wagon Bed Formation	san	fus		47.99	0.12	0.33	
Bighorn Basin								
Willwood Ash	Willwood Formation	san	fus	TCs	52.91	0.12	0.36	Smith et al. (2004)
Absaroka Volcanic Province-Intrusions								
AR76-121	Dunrud Pk rhyolite	san	dih	FCs	44.25	0.18	0.33	Hiza (1999)
AR76-120	Kirwin dacite (Mt Burwell)	hbld	dih		45.40	1.72	1.74	
AR77-184	Rampart banackite	bio	ih		47.15	0.22	0.37	
70-0-4	Ishawooa banackite	bio	ih		47.36	0.22	0.37	
HMD4-96	Sunlight (White Mt) monzogabbro	bio	dih		48.84	0.16	0.34	
HM1-94	Crandall banakite	hbld	ih		49.76	0.18	0.36	
YFP7-93	S. Gallatin Range dacite	bio	ih		50.65	0.18	0.36	
PR2-93	Golmeyer Cr andesite dike	bio	dih		52.23	0.41	0.52	
YGDC1-96	Bighorn Peak dacite	hbld			54.34	0.61	0.69	
Absaroka Volcanic Province-Extrusive								
70-0-13	Pinnacle Butte ash	san	ih		47.58	0.18	0.35	
68-0-51	Blue point ash (Irish Rock)	hbld	ih		48.32	0.20	0.36	
3497	Blue point ash (Two Ocean)	feld	ih		48.42	0.14	0.33	
P-348	Lost Creek tuff	san	ih		49.41	0.16	0.35	
P-306	Pacific Creek tuff	bio	ih		49.52	0.24	0.39	
YCS-5-95	Slough Creek tuff Asian Member	san	ih		50.26	0.16	0.35	
YCS-3-95	Slough Creek tuff upper rhyolitic unit	bio	dih		50.44	0.20	0.37	
HHM17B-95	Crandall trachyte ash- flow tuff	bio	ih		50.66	0.28	0.42	
YRL1-93	Sepulcher Mtn ash- flow	bio	dih		54.05	0.61	0.69	

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Absaroka Volcanic Province-Independence Volcano								
2085	Independence stock	bio	ih	Mmhb	49.10	0.12	0.33	
1054	"	"	ih		49.13	0.12	0.33	
IN8	"	"	ih		49.23	0.15	0.34	
2117	"	"	ih		49.69	0.11	0.33	
1077	dacite sill	bio	ih		50.58	0.17	0.36	
91IN2	basal dacite breccia above Paleozoic	hbd	ih		52.17	0.14	0.35	
Absaroka Volcanic Province-Washburn Volcano								
MW9743	andesite	gm	ih iso	Mmhb	52.54	0.81	0.87	
MW9746	sulphur creek stock	bio	ih iso		53.25	0.20	0.39	
MW97-01	dacitic lava flow at base of sequence	gm	ih iso		55.88	0.61	0.70	
Absaroka Volcanic Province-Sunlight Volcano								
SV97-02	upper Trout Peak Trachyandesite	gm	ih	Mmhb	48.69	0.10	0.32	
SV97-37	trachytic core of Copper Lakes stock	bio	ih		48.73	0.08	0.31	
SV97-07	base of Trout Peak Trachyandesite	gm	ih		48.95	0.10	0.32	
SV97-14	top of lower Trout Peak Trachyandesite	gm	ih		49.09	0.10	0.32	
SV97-33	trachyte dike on Black Mtn	bio	ih		49.81	0.10	0.33	
SV97-03	base of Jim Mountain Mb. of Wapiti Fm. "Langford Fm." on Black Mtn.	plag	ih		50.11	0.16	0.35	
SV97-29		amph	ih		50.16	0.16	0.35	
Crazy Mountains								
diorite and gabbro	Big Timber Stock	bio	?	Mmhb	49.81	0.14	0.34	S.S. Harlan, in Wilson and Elliot (1997)
	"	bio	?		49.94	0.22	0.38	
quartz monzodiorite	"	bio	?		49.84	0.20	0.37	
	"	bio	?		49.94	0.24	0.39	
SE Challis Volcanics								
DG-711-88	porphyritic rhyolite intrusion (Trpi: Navarre Creek Dome)	bio	ih	Mmhb	48.06	0.26	0.40	
MD-620-88	rhyolite dike (Trpi)	bio	ih		48.41	0.26	0.40	
JDB-422-87	rhyolite intrusion Porphyry Peak (Tri)	bio	ih		48.90	0.26	0.40	
KK-345-89	Garfield stock (Tg)	bio	dih		49.11	0.26	0.40	
LS-396-89	upper dacite flow/dome (Tdu)	bio	ih		47.89	0.26	0.40	
LS-659-89	tuff of Stoddard Gulch (Ts)	bio	ih		47.89	0.26	0.40	
FJM-72B-87	ryolite flow/dome complex at The Needles (Tru)	san	ih		48.03	0.32	0.44	
LS-392-89	lower rhyolite lavas (Tri)	bio	ih		48.69	0.57	0.64	
JDB-462-87	lower latite lavas (TII)	bio	ih		49.40	0.34	0.46	
LS-616c-87	lower dacite flow/dome (Tdl)	bio	ih		49.46	0.49	0.57	
Tru	rhyolite flow	san	ih	Mmhb	48.03	0.32	0.44	
TII	tuff breccia	bio	ih		49.40	0.34	0.46	
Tri	Boone Creek stock	bio	ih		49.46	0.26	0.40	
Tch	tuff of Cherry Creek	san	ih		49.47	1.03	1.08	
Tdl	tuff breccia	bio	ih		49.53	0.53	0.61	

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S Challis Volcanics								
88-141	tuff in Wet Creek cglm	san	ih	Mmhb	45.96	0.20	0.35	Janecke and Snee (1993)
88-136	Tuff of Challis Creek	san	ih		46.26	0.20	0.35	
88-100	rhyolite tuff	san	ih		46.67	0.40	0.50	
88-134	tuff of mud lake	bio	dih		48.29	0.40	0.50	
88-222	tuff in andesite flows	hbd	ih		48.80	0.81	0.86	
88-138	dacite of Warren Mt	hbd	ih		49.00	0.61	0.68	
88-146	andesite lava flow	hbd	dih		49.10	0.20	0.37	
88-133	dacite of Crow's Nest Canyon	hbd	ih		49.20	0.20	0.37	
88-139	dacite of Warren Mt.	hbd	ih		49.40	0.40	0.51	
88-88	tuff in andesite flows	bio	ih		49.61	0.40	0.51	
88-143	dacite lava flow	hbd	ih		49.81	0.61	0.68	
8 (Tc 1)	vitric tuff above (5) Lehmi Pass, Beaverhead Mtns	san	fus	TCs	48.97	0.25	0.40	M'Gonigle and Dalrymple (1996)
7 (88-100)	basal lithic tuff Tendoy Mtns	san	fus		49.21	0.35	0.47	
6 (87-64)	basal lithic tuff Tendoy Mtns	san	fus		49.64	0.37	0.49	
5 (Tcq)	basal rhyolite tuff Lehmi Pass, Beaverhead Mtns	san	fus		49.67	0.25	0.40	
Panther Creek Basin								
6-22-4	Tck - Tuffs of Castle Rock	san	ih	Mmhb	45.92	0.20	0.35	Janecke et al. (1997)
93-1	Tuffs of Challis Creek	san	ih		46.26	0.16	0.33	
6-18-10	Tvl1 -Fractured ash flow tuff	san	ih		46.29	0.20	0.35	
Horse Prairie Basin								
8	aphanitic mafic lava flow overlying Bloody Dick fault	gm	ih	FCs	48.13	0.85	0.90	Vandenburg et al. (1998)
5	top of undivided Challis volcanics	san	fus		48.15	0.26	0.40	
7	volcanic breccia within Ts1	gm	dih		48.18	1.19	1.23	
4	base of undivided Challis volcanics	san	fus		49.57	0.34	0.46	
3	base of undivided Challis volcanics	san	fus		50.01	1.34	1.37	
13 (82-322)	rhylolitic ash-flow tuff, top of CVG	san	fus	TCs	46.91	0.35	0.46	M'Gonigle and Dalrymple (1996)
11 (88-59)	rhylolitic welded ash-flow tuff in basal volcanics	san	fus		47.07	0.41	0.51	
3 (82-528)	basal crystal-lithic tuff	san	fus		49.80	0.35	0.47	
Muddy Creek Basin								
4	10 cm tephra in tuffaceous shale	san	fus	FCs	45.76	0.45	0.53	Janecke et al. (1999)
2	biotitic ash flow tuff in facies A	san	fus		47.68	0.53	0.60	
1	quartzite bearing ash flow tuff - basal unit	san	fus		50.11	0.10	0.33	
9 (91-171)	crystal-lithic tuff base of tuffaceous facies	san	fus	TCs	48.07	0.27	0.41	M'Gonigle and Dalrymple (1996)
Sage Creek Basin								
17 (91-170)	crystal tuff	san	fus	TCs	46.51	0.22	0.38	M'Gonigle and Dalrymple (1996)

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Medicine Lodge Basin								
18 (91-104)	lithic tuff, overlying Proterozoic	san	fus	TCs	46.00	0.27	0.40	M'Gonigle and Dalrymple (1996)
16 (87-63)	rhyolitic welded ash-flow tuff	san	fus		46.67	0.29	0.42	
15 (89-135-4)	crystal-lithic tuff, overlies (10)	san	fus		46.69	0.33	0.45	
14 (82-551)	crystal-lithic tuff	san	fus		46.76	0.29	0.42	
12 (81-189)	rhyolitic ash-flow tuff	san	fus		47.02	0.31	0.43	
10 (89-135-3)	crystal-lithic tuff	san	fus		47.36	0.37	0.48	
4 (82-504)	basal rhyolite	san	fus		49.72	0.37	0.49	
Lowland Creek Volcanics								
LVC-32	intrusive rhyolite	san	ih	Mmhb	49.11	0.49	0.57	Ispolatov (1997)
LVC-15	dacite porphyry	hblb	ih		50.39	0.47	0.56	
LVC-18	andesite porphyry	plag	ih		50.90	2.15	2.17	
LVC-6	rhyodacite porphyry clast in rhyolite tuff	bio	ih		52.13	0.41	0.52	
95LVC-9	rhyodacite porphyry fl.	hblb	ih		52.95	0.39	0.51	
95LVC-10A	rhyolite tuff	bio	ih		54.08	0.28	0.44	
LVC-19-3	andesite porphyry	plag	ih		53.34	1.93	1.96	
95LVC-7	intrusive rhyolite porphyry	hblb	ih		53.38	0.24	0.41	

Notes: All ages calculated relative to the 28.201 Ma age for FCs using the equations of Kuiper et al. (2008) and Renne et al. (1998), and are shown with 2σ analytical and fully propagated uncertainties. Mineral dated: san-sanidine, bio-biotite, hblb-hornblende, gm-groundmass, plag-plagioclase, feld-feldspar. Analysis type: ih-plateau age from incremental heating experiment, dih-discordant plateau age from incremental heating experiment, iso-inverse isochron from incremental heating experiment, fus-fusion age. Neutron flux monitor: TCs-Taylor Creek Rhyolite sanidine, FCs-Fish Canyon Tuff sanidine, Mmhb-McClure Mountain hornblende.

[†]Analytical uncertainty.

[‡]Fully propagated uncertainty for preferred age.

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