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Hyland, E.G., Sheldon, N.D., Smith, S.Y., and Strömberg, C.A.E., 2018, Late Miocene rise and fall of C_4 grasses in the western United States linked to aridification and uplift: GSA Bulletin, https://doi.org/10.1130/B32009.1.

Data Repository

Table DR1. Paleosol data and proxy calculations

Table DR2. Phytolith morphotype counts

Table DR3. Organic carbon isotope data

Table DR4. Summary of sites in the region

Table DR1. Paleosol data and proxy calculations

Locality	Formation	Age (Ma)	Bk Thickness (cm)	CaO (%)	MgO (%)	Na2O (%)	K2O (%)	Al2O3 (%)	PWI	CIA-K	MAT (˚C)	MAP (mm/yr)	MARP (mm/yr)
Robb Creek	Sixmile Creek	4.0	25	2.89	2.78	1.33	2.49	14.45	45.7	66.1	10.9	814	33
Beaverhead	Sixmile Creek	4.5	40	4.97	1.65	1.53	2.40	12.26	49.4	51.5	10.7	610	45
Timber Hill	Sixmile Creek	7.7	18	2.78	2.50	1.87	2.40	13.25	47.2	62.0	10.8	750	28
Timber Hill	Sixmile Creek	8.2	20	1.61	1.63	1.59	2.59	13.32	38.6	70.6	11.4	889	30
Sweetwater	Sixmile Creek	10.3	25	3.71	2.97	1.05	2.00	12.97	44.7	60.5	11.0	728	33
Madison	Sixmile Creek	11.1	19	2.16	1.92	1.19	3.16	12.90	42.4	68.7	11.1	855	29
Railroad Canyon	Sixmile Creek	12.3	29	2.41	1.59	1.32	3.46	11.79	44.6	64.3	11.0	784	37

* Data from Retallack (2007)

Table DR2. Phytolith count data

Morphotype (Code)[1,2]	Compound[1]	Beaverhead (BHL)														
		BHL-01	BHL-02	BHL-03	BHL-04	BHL-05	BHL-06	BHL-07	BHL-08	BHL-09	BHL-10	BHL-11	BHL-12	BHL09-01	BHL09-02	BHL09-03
Helical tracheary (Tra-1)	FI-GEN	7	12	8	5	7	0	10	5	8	4	7	5	9	6	1
Blocky polyhedron (Blo-6)	FI-GEN	18	25	11	25	13	21	15	21	22	17	18	26	11	8	25
Hollow round plate (Ho-1)	FI-GEN	16	11	19	30	26	28	5	14	18	11	16	24	12	24	13
Laminar wall trichome (Tri-4)	DICOT	0	8	0	3	0	15	3	1	3	2	0	1	0	4	0
Sedge epidermal plate (Epi-6)	SEDGE	6	3	8	0	0	7	4	6	2	4	8	5	6	0	1
Echinate sphere (Clm-2)	PALM	2	0	0	0	2	5	5	1	2	5	0	2	4	0	0
Costus-type body (Clm-4)	MAR/COST	0	0	4	0	0	0	3	0	0	2	0	0	0	0	0
Chusquea-type rondel (Co-3)	BAMB	0	0	0	0	0	2	0	0	0	0	0	0	0	3	1
Four-lobed cross (Cr-4)	PANI	21	19	17	5	9	6	6	6	4	7	8	3	10	6	12
Equant polylobate (Po-4)	PANI	4	0	0	4	3	4	12	4	10	3	6	16	6	11	14
Panicoid bilobate (Bi-8)	PANI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crescentic conical rondel (Co-5)	CHLOR	3	3	13	2	0	1	5	4	4	12	12	3	7	3	3
Pseudo-saddle (Sa-2)	CHLOR	8	13	3	4	6	4	0	13	6	3	19	14	12	16	13
Inverted bilobate (Bi-6)	PACMAD	6	0	5	5	3	1	5	7	6	7	7	0	1	5	4
Simple bilobate (Bi-5)	PACMAD	15	14	14	9	19	5	17	15	15	17	19	11	8	23	17
Generic conical rondel (Co-1)	POOID	40	41	49	52	56	63	45	57	45	44	49	39	42	40	51
Truly conical rondel (Co-2)	POOID	24	28	23	32	31	22	12	21	18	17	20	17	28	0	12
Regular keeled rondel (Kr-1)	POOID	11	9	14	6	11	7	12	5	14	15	12	15	17	13	12
Trapezoidal polylobate (Po-1)	POOID	1	0	0	0	1	1	2	0	6	2	5	4	2	8	0
Symmetrical (A) crenate (Ce-1)	POOID	4	0	12	5	6	0	13	4	10	19	14	12	8	8	16
Spindle-shaped trichome (Tri-8)	GRASS	2	0	0	4	0	4	7	2	9	11	10	12	0	6	8
Elongate [indented] (Epi-11)	GRASS	13	7	4	11	7	0	6	0	2	8	8	4	13	7	0
Elongate [dendriform] (Epi-9)	GRASS	4	12	11	8	7	14	17	19	14	10	5	10	4	18	22
Pitted rod tracheary (Tra-8)	GRASS	0	0	0	0	3	0	6	0	2	5	2	2	0	1	0
Smooth elongates (Elo-1/Elo-2)	OTH	43	35	28	50	25	66	50	72	44	48	41	54	40	56	62
Diatom (biraphic, centric)	OTH	16	12	8	9	17	9	21	0	21	24	33	8	12	39	0
Sponge	OTH	0	0	0	0	0	3	8	0	3	2	1	0	0	4	0
	TOTAL	264	252	251	269	252	288	289	277	288	299	320	287	252	309	287
	DIAGNOSTIC	205	205	215	210	210	210	210	205	220	225	245	225	200	210	225
	FI (%)	21.6	27.7	20.3	30.0	22.9	35.0	19.9	21.1	24.3	18.6	17.3	26.4	18.6	21.4	17.9
	CI (±%)*	5.7	6.2	5.6	6.2	5.7	6.5	5.4	5.6	5.7	5.1	4.9	5.8	5.5	5.6	5.0
	MIN C4 (%)	18.1	17.3	15.9	7.1	8.6	7.4	11.2	13.6	11.0	11.3	19.0	16.4	18.0	17.1	18.8
	CI(±%)*	5.3	5.2	5.0	3.5	3.7	3.6	4.3	4.8	4.2	4.1	5.0	4.8	5.4	5.1	5.1
	MAX C4 (%)	28.6	24.3	25.1	13.8	19.0	10.3	21.8	24.6	20.6	22.2	30.0	21.4	22.7	30.5	28.1
	CI (±%)*	6.4	6.0	5.9	4.7	5.3	4.2	5.7	6.0	5.4	5.4	5.8	5.4	5.8	6.2	6.0

1. Classifications and compound types from Strömberg (2003)
2. Classifications from Bozarth (1992)
* Confidence intervals based on bootstrapping method of Chen et al. (2015)

Table DR2. (continued)

Morphotype (Code)	Compound	Beaverhead (BHL) 09-04	09-05	09-06	09-07	09-08	09-09	09-10	09-11	09-12	09-13	09-14	09-15	09-16	09-17	09-18
Helical tracheary (Tra-1)	FI-GEN	0	9	0	4	3	3	5	0	0	0	15	7	7	7	2
Blocky polyhedron (Blo-6)	FI-GEN	23	0	26	14	17	23	14	11	12	19	18	20	26	22	17
Hollow round plate (Ho-1)	FI-GEN	5	12	20	18	15	24	21	20	22	18	30	21	33	18	24
Laminar wall trichome (Tri-4)	DICOT	0	0	2	7	7	6	2	6	3	3	7	5	11	4	9
Sedge epidermal plate (Epi-6)	SEDGE	0	2	4	1	0	4	2	3	1	0	5	3	14	7	7
Echinate sphere (Clm-2)	PALM	0	0	1	0	1	0	2	0	2	4	0	0	2	3	2
Costus-type body (Clm-4)	MAR/COST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chusquea-type rondel (Co-3)	BAMB	3	0	1	0	0	3	0	0	0	0	0	0	2	4	0
Four-lobed cross (Cr-4)	PANI	9	18	3	2	4	5	4	8	7	11	10	11	1	3	9
Equant polylobate (Po-4)	PANI	8	2	2	0	1	6	5	0	2	2	4	3	2	2	1
Panicoid bilobate (Bi-8)	PANI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crescentic conical rondel (Co-5)	CHLOR	5	13	5	4	3	8	5	5	7	6	2	0	0	4	9
Pseudo-saddle (Sa-2)	CHLOR	11	23	13	21	13	7	8	14	15	17	5	8	16	2	16
Inverted bilobate (Bi-6)	PACMAD	2	7	8	8	9	2	9	11	8	4	4	3	1	4	5
Simple bilobate (Bi-5)	PACMAD	12	24	15	15	13	10	12	13	11	10	4	3	4	2	11
Generic conical rondel (Co-1)	POOID	45	43	57	69	61	54	72	51	48	36	51	62	61	67	53
Truly conical rondel (Co-2)	POOID	18	18	23	32	24	23	27	15	17	32	19	21	15	35	28
Regular keeled rondel (Kr-1)	POOID	8	21	9	10	3	2	8	13	12	12	8	8	9	5	11
Trapezoidal polylobate (Po-1)	POOID	0	0	2	0	12	0	1	1	2	0	1	1	0	0	3
Symmetrical (A) crenate (Ce-1)	POOID	11	2	0	1	2	2	1	6	5	8	2	2	3	2	1
Spindle-shaped trichome (Tri-8)	GRASS	9	0	6	3	4	5	4	4	9	3	4	5	10	8	4
Elongate [indented] (Epi-11)	GRASS	1	1	1	2	2	0	0	0	2	6	2	0	0	0	0
Elongate [dendriform] (Epi-9)	GRASS	35	15	14	16	12	16	6	24	20	9	16	20	7	10	7
Pitted rod tracheary (Tra-8)	GRASS	0	0	3	3	4	2	2	0	0	0	3	2	1	1	1
Smooth elongates (Elo-1/Elo-2)	OTH	100	34	49	108	95	61	70	36	44	56	64	54	51	75	58
Diatom (biraphic, centric)	OTH	1	22	19	22	22	17	53	13	17	14	27	20	11	6	7
Sponge	OTH	0	0	0	3	0	3	0	0	2	0	6	1	3	0	0
	TOTAL	306	266	283	363	327	286	333	254	268	270	307	280	290	291	285
	DIAGNOSTIC	205	210	215	230	210	205	210	205	205	200	210	205	225	210	220
	FI (%)	15.1	10.1	23.7	18.8	20.5	29.4	21.2	18.3	19.1	22.0	34.1	26.2	38.4	28.6	25.4
	CI (±%)	4.9	4.1	5.7	5.0	5.5	6.2	5.6	5.3	5.3	5.7	6.4	6.0	6.6	6.2	5.8
	MIN C4 (%)	16.1	26.4	10.9	11.8	10.0	12.9	10.6	13.4	15.2	18.0	10.2	10.9	9.0	5.4	16.4
	CI(±%)	5.1	6.0	4.2	4.2	4.1	4.6	4.2	4.7	4.9	5.3	4.1	4.2	3.9	3.1	5.0
	MAX C4 (%)	22.9	41.8	21.8	21.8	20.5	18.9	20.7	25.2	24.5	25.0	14.1	13.9	11.4	8.4	23.9
	CI (±%)	5.7	6.6	5.5	5.4	5.4	5.4	5.5	5.9	5.8	5.9	4.8	4.8	4.3	3.8	5.7

Table DR2. (continued)

		Beaverhead (BHL)														
Morphotype (Code)	Compound	09-19	09-20	09-21	09-22	09-23	09-24	09-25	09-26	09-27	09-28	09-29	09-30	09-31	09-32	09-33
Helical tracheary (Tra-1)	FI-GEN	0	6	3	7	8	4	0	1	4	0	0	2	0	2	5
Blocky polyhedron (Blo-6)	FI-GEN	22	25	28	18	13	15	13	19	19	28	16	25	21	25	6
Hollow round plate (Ho-1)	FI-GEN	19	21	29	20	9	11	15	14	29	18	18	15	8	13	8
Laminar wall trichome (Tri-4)	DICOT	8	6	14	3	0	8	3	4	7	5	1	13	0	10	3
Sedge epidermal plate (Epi-6)	SEDGE	5	5	4	7	0	1	0	0	0	0	0	2	0	4	0
Echinate sphere (Clm-2)	PALM	3	3	2	1	1	6	2	4	0	0	2	5	0	0	6
Costus-type body (Clm-4)	MAR/COST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chusquea-type rondel (Co-3)	BAMB	1	0	0	0	2	3	5	0	0	6	0	0	0	0	2
Four-lobed cross (Cr-4)	PANI	7	2	2	5	23	10	5	6	9	4	7	2	14	1	6
Equant polylobate (Po-4)	PANI	4	2	0	13	2	6	5	11	4	0	2	0	5	3	0
Panicoid bilobate (Bi-8)	PANI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Crescentic conical rondel (Co-5)	CHLOR	6	11	2	11	24	6	7	6	2	2	7	2	0	4	3
Pseudo-saddle (Sa-2)	CHLOR	11	4	5	10	22	18	22	19	3	6	5	6	20	13	14
Inverted bilobate (Bi-6)	PACMAD	4	5	4	6	6	5	11	5	10	8	7	1	0	5	0
Simple bilobate (Bi-5)	PACMAD	9	6	11	12	19	22	22	12	19	17	20	16	16	14	9
Generic conical rondel (Co-1)	POOID	48	57	43	31	34	50	41	59	52	44	53	56	51	42	62
Truly conical rondel (Co-2)	POOID	26	26	30	21	12	18	21	10	21	7	18	11	19	17	44
Regular keeled rondel (Kr-1)	POOID	13	15	13	14	15	11	14	13	12	10	13	6	13	12	8
Trapezoidal polylobate (Po-1)	POOID	1	0	0	1	4	4	4	0	0	5	3	0	4	6	0
Symmetrical (A) crenate (Ce-1)	POOID	3	2	0	4	13	2	3	4	6	11	9	9	5	8	0
Spindle-shaped trichome (Tri-8)	GRASS	4	4	2	12	2	3	1	5	0	7	1	8	6	8	10
Elongate [indented] (Epi-11)	GRASS	1	0	0	0	5	0	2	1	0	4	0	2	10	6	7
Elongate [dendriform] (Epi-9)	GRASS	13	10	6	6	8	12	20	20	16	23	24	29	13	25	9
Pitted rod tracheary (Tra-8)	GRASS	2	5	7	3	3	0	4	2	2	5	4	0	0	2	0
Smooth elongates (Elo-1/Elo-2)	OTH	44	32	56	48	62	62	31	77	46	47	42	67	31	52	58
Diatom (biraphic, centric)	OTH	12	19	16	16	26	11	43	11	20	20	12	23	8	6	6
Sponge	OTH	0	1	1	7	0	0	1	0	6	0	0	0	0	1	0
	TOTAL	266	267	278	276	313	288	295	303	287	277	264	300	244	279	269
	DIAGNOSTIC	210	215	205	205	225	215	220	215	215	210	210	210	205	220	205
	FI (%)	25.9	29.0	37.8	24.7	14.7	22.0	17.3	19.5	27.4	27.1	17.6	28.8	14.1	23.1	14.6
	CI (±%)	6.0	6.0	6.8	6.0	4.6	5.5	5.0	5.4	5.9	6.0	5.2	6.2	4.9	5.6	4.9
	MIN C4 (%)	13.7	9.0	4.5	19.7	31.6	18.7	17.7	19.5	8.4	5.7	10.0	4.8	19.0	9.7	12.7
	CI(±%)	4.7	3.9	2.8	5.6	6.1	5.2	5.0	5.3	3.7	3.1	4.0	2.9	5.3	4.0	4.5
	MAX C4 (%)	20.0	14.3	11.9	28.8	42.7	31.3	32.7	27.4	21.9	17.6	22.9	13.0	26.8	18.5	17.1
	CI (±%)	5.5	4.8	4.5	6.2	6.4	6.2	6.2	5.8	5.5	5.2	5.7	4.5	6.2	5.2	5.3

Table DR2. (continued)

Morphotype (Code)	Compound	Beaverhead (BHL) 09-34	09-35	09-36	09-37	09-38	09-39	09-40	09-41	09-42	09-43	09-44	09-45
Helical tracheary (Tra-1)	FI-GEN	0	2	0	6	2	1	6	2	2	0	0	1
Blocky polyhedron (Blo-6)	FI-GEN	23	18	34	11	29	23	18	20	14	26	28	28
Hollow round plate (Ho-1)	FI-GEN	20	27	24	18	16	32	18	19	11	24	16	19
Laminar wall trichome (Tri-4)	DICOT	6	1	9	2	4	5	1	0	5	1	1	2
Sedge epidermal plate (Epi-6)	SEDGE	0	0	1	0	0	3	5	4	6	5	4	5
Echinate sphere (Clm-2)	PALM	3	4	0	5	0	1	1	2	0	2	2	0
Costus-type body (Clm-4)	MAR/COST	0	0	0	0	0	0	0	0	0	0	0	0
Chusquea-type rondel (Co-3)	BAMB	0	6	0	0	0	1	0	6	4	2	2	0
Four-lobed cross (Cr-4)	PANI	7	10	2	3	1	5	9	6	2	2	6	5
Equant polylobate (Po-4)	PANI	3	0	4	0	3	5	7	6	12	0	13	10
Panicoid bilobate (Bi-8)	PANI	0	3	0	0	0	0	0	0	0	0	0	3
Crescentic conical rondel (Co-5)	CHLOR	3	0	6	7	5	6	6	6	3	6	7	4
Pseudo-saddle (Sa-2)	CHLOR	8	0	6	0	11	7	8	9	9	7	7	6
Inverted bilobate (Bi-6)	PACMAD	4	8	0	0	5	0	7	16	10	7	5	0
Simple bilobate (Bi-5)	PACMAD	9	12	9	5	13	18	18	15	27	15	13	7
Generic conical rondel (Co-1)	POOID	53	38	45	58	50	49	43	50	40	44	40	47
Truly conical rondel (Co-2)	POOID	36	33	17	47	14	18	12	10	15	24	16	37
Regular keeled rondel (Kr-1)	POOID	14	16	11	13	9	2	7	5	9	9	6	4
Trapezoidal polylobate (Po-1)	POOID	2	0	8	0	5	0	2	0	2	6	3	0
Symmetrical (A) crenate (Ce-1)	POOID	6	9	7	5	7	3	5	1	0	4	9	2
Spindle-shaped trichome (Tri-8)	GRASS	4	8	8	12	11	7	11	7	12	8	14	11
Elongate [indented] (Epi-11)	GRASS	4	7	3	9	11	3	2	3	0	2	0	2
Elongate [dendriform] (Epi-9)	GRASS	10	8	11	9	18	8	31	22	22	17	21	13
Pitted rod tracheary (Tra-8)	GRASS	0	0	5	0	6	3	3	1	0	4	2	4
Smooth elongates (Elo-1/Elo-2)	OTH	47	27	56	33	74	59	67	76	84	69	72	64
Diatom (biraphic, centric)	OTH	25	37	30	26	38	17	19	13	13	27	34	21
Sponge	OTH	2	0	0	0	0	0	0	0	3	2	0	0
	TOTAL	289	274	296	269	332	276	306	299	305	313	321	295
	DIAGNOSTIC	215	210	210	210	220	200	220	210	205	215	215	210
	FI (%)	24.2	27.6	32.1	20.0	23.2	32.0	20.5	23.8	18.1	26.2	23.2	24.4
	CI (±%)	5.7	6.0	6.3	5.4	5.6	6.5	5.3	5.8	5.3	5.9	5.7	5.8
	MIN C4 (%)	9.8	6.2	8.6	4.8	9.1	11.7	14.0	13.1	12.7	7.1	15.6	13.7
	CI(±%)	4.0	3.2	3.9	3.0	3.8	4.5	4.7	4.6	4.5	3.5	4.9	4.7
	MAX C4 (%)	15.8	15.7	12.9	7.1	17.3	20.8	25.6	28.2	31.7	17.6	24.2	17.1
	CI (±%)	4.9	4.9	4.6	3.5	4.9	5.7	5.9	6.2	6.4	5.2	5.6	5.2

Table DR2. (continued)

		Robb Creek (RC)					
Morphotype (Code)	Compound	08-61	08-62	08-63	08-64	08-65	08-67
Helical tracheary (Tra-1)	FI-GEN	0	0	2	2	0	0
Blocky polyhedron (Blo-6)	FI-GEN	33	23	24	22	21	30
Hollow round plate (Ho-1)	FI-GEN	0	0	18	8	0	0
Laminar wall trichome (Tri-4)	DICOT	0	0	0	0	0	0
Sedge epidermal plate (Epi-6)	SEDGE	0	0	0	0	0	0
Echinate sphere (Clm-2)	PALM	4	4	6	6	4	14
Costus-type body (Clm-4)	MAR/COST	0	0	0	0	0	0
Chusquea-type rondel (Co-3)	BAMB	0	0	0	0	0	0
Four-lobed cross (Cr-4)	PANI	4	3	0	0	6	2
Equant polylobate (Po-4)	PANI	7	9	1	0	4	2
Panicoid bilobate (Bi-8)	PANI	8	8	0	0	0	0
Crescentic conical rondel (Co-5)	CHLOR	3	1	0	5	0	0
Pseudo-saddle (Sa-2)	CHLOR	8	7	1	3	2	3
Inverted bilobate (Bi-6)	PACMAD	0	2	3	1	5	2
Simple bilobate (Bi-5)	PACMAD	7	11	7	4	7	4
Generic conical rondel (Co-1)	POOID	32	53	60	87	64	73
Truly conical rondel (Co-2)	POOID	11	10	21	27	13	18
Regular keeled rondel (Kr-1)	POOID	5	3	4	7	10	2
Trapezoidal polylobate (Po-1)	POOID	8	6	0	0	10	6
Symmetrical (A) crenate (Ce-1)	POOID	11	16	17	5	6	10
Spindle-shaped trichome (Tri-8)	GRASS	30	19	26	23	25	20
Elongate [indented] (Epi-11)	GRASS	0	0	0	0	0	3
Elongate [dendriform] (Epi-9)	GRASS	39	35	20	15	43	16
Pitted rod tracheary (Tra-8)	GRASS	0	0	0	0	0	0
Smooth elongates (Elo-1/Elo-2)	OTH	52	46	41	59	64	41
Diatom (biraphic, centric)	OTH	6	7	4	3	2	26
Sponge	OTH	4	0	0	7	1	5
	TOTAL	272	263	255	284	287	277
	DIAGNOSTIC	210	210	210	215	220	205
	FI (%)	17.6	12.9	23.8	17.7	11.4	21.5
	CI (±%)	5.1	4.5	5.8	5.1	4.1	5.6
	MIN C4 (%)	14.3	13.3	1.0	3.7	5.5	3.4
	CI(±%)	4.7	4.5	1.0	2.5	2.9	2.5
	MAX C4 (%)	17.6	19.5	5.7	6.0	10.9	6.3
	CI (±%)	5.2	5.3	3.1	3.1	4.1	3.3

Table DR3. Carbon stable isotope data

	Sample	Height (m)	OC (%)	δ^{13}Corg (‰)†	C_4 (%)††
Beaverhead (BHL)	BHLX-1	4.4	0.12	-22.40	17.7
	BHLX-2	9.0	0.16	-22.60	16.1
	BHLX-3	16.8	0.14	-22.63	15.9
	BHLX-4	19.5	0.08	-23.51	9.2
	BHLX-5	27.6	0.17	-20.88	29.4
	BHLX-6	31.0	0.15	-22.09	20.1
	BHLX-7	40.0	0.12	-21.81	22.3
	BHLX-8	42.8	0.13	-22.33	18.2
Robb Creek (RC)	RCX-4	2.0	0.07	-24.63	6.3
	RCX-8	2.5	0.06	-23.22	16.3
	RCX-17	2.8	0.12	-24.56	6.8
	RCX-18	3.0	0.10	-25.01	3.5
	RCX-19	5.2	0.13	-23.44	14.7
	RCX-21	5.2	0.07	-24.01	10.7
	RCX-22	5.2	0.08	-24.89	4.4
	RCD-1*	5.5	0.10	-23.94	11.2
	RCD-2*	5.5	0.11	-22.83	19.1
	RCD-3*	5.5	0.14	-24.23	9.1
Big Sky (BS)	RBMS-1		0.42	-24.14	14.0
	RBMS-2		0.21	-24.73	9.8
	RBMS-10		0.58	-23.94	15.5
	RBMS-11		0.47	-23.82	16.3
	RBMS-15		1.03	-24.63	10.5
	RBMS-16		0.73	-23.73	16.9

† Average organic carbon composition based on ~3 analyses per sample.

† † Estimate based on modeled C_3 endmembers of -24.7‰ for the Miocene, -25.5‰ for the Pliocene, and -26.1‰ for the modern, and modeled C_4 endmembers of -11‰ for the Miocene, -11.5‰ for the Pliocene, and -12.1‰ for the modern (e.g., Diefendorf et al., 2010; Tipple et al., 2010; Cotton et al., 2012).

* Samples from Section B.

Table DR4. Summary of sites in the region

Site	Age (Ma)	Phytolith % C_4 (Ave.)	Isotope % C_4 (Ave.)	Census/ satellite	Source
Railroad Canyon	22-15	0-10 (3%)	0-6 (3%)	------	Harris et al. (2017)
Madison Buffalo Jump (MBJ)	11-10	1-5 (3%)	0-13 (6%)	------	Chen et al. (2015)
Trace Fossil Site (TFF)	10-9	0-18 (8%)	0-18 (7%)	------	Cotton et al. (2012)
Beaverhead (BHL)	8-6	4-43 (21%)	9-29 (20%)	------	*This work*
Robb Creek (RC)	3-2	1-20 (11%)	4-19 (10%)	------	*This work*
Big Sky (BS)	0	------	10-18 (14%)	12-20 (15%)	*This work*; DAAC (2014)
Red Lodge	0	------	------	20-40 (28%)	DAAC (2014)
Bighorn	0	------	------	40-60 (45%)	DAAC (2014)
Badlands	0	------	------	60-70 (65%)	DAAC (2014)

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