

2001089—Appendix A. Incision rate localities, western United States

Dethier, p. 1

Location	State	Terrace height above base level m	River	Estimated incision rate* cm k.y. ⁻¹	Reference	Notes
Little Colorado R	Arizona		Little Colorado	8.7	Patton et al., 1991	70 m since 0.87 Ma lower 150 km; <61 m per 10 ⁶ yr upper river (basalt dams)
Clifton	Arizona	50	Gila	8	Morrison, 1965; 1991	25-75 m above river in upper Duncan V.; >50 m south of Clifton; overlies paleolacustrine.
upper Grand Canyon	Arizona	<120	Colorado	20	Patton et al., 1991	100 m incision since ~ 500 ka and increasing; "none at Lava Falls past 10 ⁶ yr
western Grand Canyon	Arizona		Colorado	16	Lucchitta et al., 2000	Impeded by volcanic debris
Glenwood Springs	Colorado	85	Colorado	14	Streufort et al., 1997a; Scott and Shroba, 1997	4.5 km s. of its junction with the Eagle River
Eagle	Colorado	60	Eagle River	10	David Lidke, unpub., 1995	Low because of evaporite dissolution? 26 km e. of its junction with the Colorado R.
Carbondale	Colorado	88	Roaring Fork	15	Piety, 1981	
Meeker	Colorado	82	White River	14	Whitney et al., 1983	
Durango area	Colorado	160	Animas	26.7	Patton et al., 1991	Within glacial limit
Steamboat Springs	Colorado	64	Elk	11	Reheis et al., 1991	Yampa R drainage
Sterling	Colorado	43	S. Platte	7	in Pierce and Morgan, 1992	
Buena Vista	Colorado	48-61	Arkansas	9	Scott, 1975	
S. Buena Vista	Colorado	61	Arkansas	10 (20)	Scott et al., 1975	Bishop ash associated with 73-85 m terrace
Piedra	Colorado	80	Piedra	13	Dave Moore, unpub., 1998	
Gem Village	Colorado	183?	Los Pinos	30	Dave Moore, unpub., 1998	
De Soto	Kansas	23-30	Kansas	4	Madole et al., 1991	Beneath Menoken Terrace, which overlies glaciofluvial deposits with LCB
Emporia	Kansas	15-21	Neosho	3	Madole et al., 1991	Along Cottonwood R (a trib.) beneath Emporia terrace
Flint Hills area	Kansas	>11, <40?	Arkansas		Madole et al., 1991	Mainly buried
OSU transect C	Kansas	21	Arkansas	3.5	Carter et al., 1990	
OSU transect B	Kansas	14	Arkansas	2.3	Carter et al., 1990	
Snake River plain	Idaho		Snake	<2	in Pierce and Morgan, 1992	
Snake River plain	Idaho		Snake	<3	in Pierce and Morgan, 1992	
Snake River plain	Idaho		Snake	<4	in Pierce and Morgan, 1992	
Snake River plain	Idaho		Snake	<4	in Pierce and Morgan, 1992	
Snake River plain	Idaho		Snake	<4	in Pierce and Morgan, 1992	
upper Yellowstone	Montana	100	upper Yellowst	16	in Pierce and Morgan, 1992	
Rock Creek	Montana	65	Rock Creek	11	Reheis et al., 1991	
lower Bighorn River	Montana	115	Bighorn	19	Reheis et al., 1991	Lemonade Springs Terrace; incision postdates LCB--600 ka
lower Bighorn River	Montana	100	Bighorn	16	Reheis et al., 1991	Lemonade Springs Terrace; incision postdates LCB--600 ka
upper Bighorn River	Montana	100	Bighorn	16	Reheis et al., 1991	
upper Bighorn River	Montana	100	Bighorn	16	Reheis et al., 1991	
Silesia	Montana	93	I. Clarks Fork	17	Reheis et al., 1991	Lower Roberts; geology complex
Miles City	Montana	80	Yellowstone	13	Wayne et al., 1991	In uppermost deposits of best preserved terrace
Sidney	Montana	130	Yellowstone	22	Wayne et al., 1991	In uppermost deposits of best preserved terrace
Custer Co.	Montana	80	Yellowstone	13.3	Izett and Wilcox, 1982	In terrace deposit, Izett and Wilcox Montana locality 3
Tierra Amarilla	New Mexico		Chama	25	Patton et al., 1991	250 m per 10 ⁶ yr
n. Farmington area	New Mexico	100	Animas	16.7	Patton et al., 1991	"Differential uplift of the upper part of the basin"
Jemez R.	New Mexico	95	Jemez River	16	Rogers and Smartt, 1996	Gravel top slightly lower, within 20 m alluvial fill
Wagon Mound area	New Mexico		Canadian; Mo	8		Basalt flow dated at 1.4 Ma caps ancestral gravel--110 m
Española area	New Mexico	105	Rio Grande	18	Dethier et al., 1990	Rio Grande and Rio Chama
Abiquiu area	New Mexico	105	Rio Chama	18		

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Bernalillo	New Mexic	60	Rio Puerco	10	Izett and Wilcox, 1982	LCB ident. from D. Schmidt and D. Sawyer; tephra is at ~ 8!
North Farmington	New Mexic	90	Animas	15	Patton et al., 1991	
Las Cruces area	New Mexic	97	Rio Grande	16	Machette, 1985	Cut by lower La Mesa surface?
SE of Oklahoma Cit	Oklahoma	45	Canadian	7.5	Madole et al., 1991	Within Gerty Sand
S of Oklahoma City	Oklahoma	40-45??	Red	7	Madole et al., 1991	Tillman terrace, correlated with LCB locality 70 km distant
OSU transect I	Oklahoma	67	Cimarron	11.2	Carter et al., 1990	
OSU transect J	Oklahoma	43	Cimarron	6.7	Carter et al., 1990	
OSU transect D	Oklahoma	52	N. Canadian	8.7	Carter et al., 1990	174 m above Cimarron, 20 km distant?
OSU transect H	Oklahoma	46	N. Canadian	7.7	Carter et al., 1990	
OSU transect A	Oklahoma	67	Canadian	11.2	Carter et al., 1990	
OSU transect K	Oklahoma	30	Kiowa Creek	5	Carter et al., 1990	Projection to N. Canadian = 46 m
OSU transect F	Oklahoma	21	Elk Creek	3.5	Carter et al., 1990	LCB ident. from D. Sawyer, unpub. data, 1999
Custer Co.	Oklahoma	≥35	Deer Cr.	>6	Madole et al., 1991	Small tributary of Canadian; "presumably" Lava Creek
Custer Co.	Oklahoma	71-74??	Canadian	12	Madole et al., 1991	
Near Smithville	Texas	43	Colorado	7	Blum and Valastro, 1994	Probably in fill beneath Asylum Terrace
Hutchinson Co.	Texas	-65	Canadian	3.1	Izett and Wilcox, 1982	Overlain by silt, sand and gravel, Izett and Wilcox Texas locality 31; HR tephra
E. of Dallas	Texas	>20; <38	Trinity	3-6	Madole et al., 1991	No tephra; E. Fork Trinity
OSU transect L	Texas	-155	Canadian	7.4	Carter et al., 1990	Huckleberry Ridge tephra
OSU transect G	Texas	46	Brazos	7.7	Carter et al., 1990	
Green R. at Keg Kn	Utah		Green River	16-51	Patton et al., 1991	400 m of incision since ~2.5 Ma (mag)
Canyon of Ladore	Utah		Green River	15	Hansen, 1986	750 m of incision since 5 Ma (Brown's Park Fm)
Uinta Mtns	Utah	>55	Lake Fork/ Uint	>10?	Reheis et al., 1991	RAG 3 terrace; age is estimate; outwash gravels
upper Bighorn River	Wyoming	95	Bighorn	16	Reheis et al., 1991	Cottonwood terrace
Greybull River	Wyoming	95?	Greybull	16	Reheis et al., 1991	Cinder-two terrace
Shoshone River	Wyoming	95?	Shoshone	16	Reheis et al., 1991	(Bridger terrace)
Washakie Co	Wyoming	80	Spring Creek	13.3		In terrace deposits; Izett and Wilcox Wyoming locality 16
Rock Creek	Wyoming	45-90?	Rock Creek	7-15	Reheis, 1992	Different rates from different places--minimum rate upstream
Laramie	Wyoming		Laramie	<3	Reheis et al., 1991	Harmony Bench is ≤ Bishop ash age and at 18 m
upper N. Platte?	Wyoming		N. Platte?	7	in Pierce and Morgan, 1992	
Baggs	Wyoming		Little Snake	21	Izett and Wilcox, 1982	
Kinnear	Wyoming	-100	Wind River	16	Jaworowski, 1992; Izett et al., 1992	Within main stem gravel deposits
	Wyoming	>100	Muddy Creek	>16	Jaworowski, 1992; Izett et al., 1992	At base of terrace deposit
Dinwoody Lakes	Wyoming	-140	Wind River	23	Jaworowski, 1992; Izett et al., 1992	Within main stem gravel deposits; 67 km upstream from Kinnear; site C-1453

*--Calculated from height of terrace associated with Lava Creek B ash bed; values in italics were calculated from other dated horizons in fluvial terraces

Additional References Cited

- Blum, M. D. and Valastro, S., Jr., 1994, Late Quaternary sedimentation, lower Colorado River, Gulf Coastal Plain of Texas: *Geological Society of America Bulletin*, v. 106, p. 1002-1016.
- Jaworowski, Cheryl, 1992, A new Lava Creek ash locality and its implications, Wind River Basin, central Wyoming, U. S. A.: *Geological Society of America Abstracts with Programs*, v. 24, no. 6, p. 22.
- Machette, M. N., 1985, Calcic soils of the southwestern United States, in Weide, D. L., ed., *Soils and Quaternary Geology of the Southwestern United States: Geological Society of America Special Paper 203*, p. 1-21.
- Morrison, R. B., 1965, Geologic map of the Duncan and Canador Peak quadrangles, Arizona and New Mexico: U. S. Geological Survey Miscellaneous Geologic Investigations Map I-4423, scale 1:48,000, 7 p. text.
- Patton, P. C., Biggar, N., Condit, C. D., Gillam, M. L., Love, D. W., Machette, M. N., Mayer, L., Morrison, R. B., and Rosholt, J. N., 1991, Quaternary geology of the Colorado Plateau, *in* Morrison, R. B., ed., *Quaternary nonglacial geology: Conterminous U. S.: Boulder, Colorado, Geological Society of America, The Geology of North America*, v. K-2, p. 373-406.
- Piety, L. A., 1981, Relative dating of terrace deposits and tills in the Roaring Fork Valley, Colorado: Boulder, University of Colorado, M. S. thesis, 209 p.
- Rogers, J. B., and Smartt, R. A., 1996, Climatic influences on Quaternary alluvial stratigraphy and terrace formation in the Jemez River valley, New Mexico: *New Mexico Geological Society, Guidebook 47*, p. 347-356.
- Scott, G.R., 1975, Reconnaissance geologic map of the Buena Vista quadrangle, Chaffee and Park Counties, Colorado: U. S. Geological Survey Map MF-657, scale 1:62,500.
- Scott, G.R., Van Alstine, R.E., and Sharp, W.N., 1975, Geologic map of the Poncha Springs quadrangle, Chaffee County, Colorado: U.S. Geological Survey Map MF-658, scale 1:62,500.
- Scott, R. B., and Shroba, R. R., 1997, Revised preliminary geologic map of the New Castle Quadrangle, Garfield County, Colorado: U. S. Geological Survey Open-File Report 97-737, scale 1:24,000.
- Streufort, R. K., Kirkham, R. M., Schroeder, T. J., Jr., and Widmann, B. L., 1997, Geologic map of the Dotsero quadrangle, Eagle and Garfield Counties, Colorado: Colorado Geological Survey Open-File Report 97-2, 18 p, map scale 1:24,000.
- Ward, P.A. and Carter, B.J., 1999, Rates of stream incision in the middle part of the Arkansas River basin based on late Tertiary to mid-Pleistocene volcanic ash: *Geomorphology*, v. 27, p. 205-228.
- Whitney, J. W., Piety, L. A., and Cressman, S. L., 1983, Alluvial history in the White River basin, northwest Colorado: *Geological Society of America Abstracts with Programs*, v. 15, no. 5, p. 328.