TABLE DR1. STUDY SITE SEDIMENTARY DESCRIPTIONS

Number	Site Name	Location	Sedimentary Description[1]
1	Starvation Flats	36°48' N Lat, 114°54' W Long	reddish brown, ripple cross-stratified to massive, calcareous mud, interbedded with thin beds of fine sand; grades upwards to gray matrix-to-clast-supported pebbly gravel[2]
2	Table Mesa Basin	36°44' N Lat, 114°50' W Long	pink, ripple cross-stratified to massive, calcareous and gypsiferous sandy mud, interbedded with minor thin beds of very fine to fine sand, root traces; grades upwards to greenish matrix-to-clast-supported, imbricated pebble gravel
3	Moapa Gap	36°45' N Lat, 114°45' W Long	light reddish brown, normally graded, medium beds of muddy sand with lenses of fine to coarse sand, bioturbated, few calcic paleosol horizons
4	Glendale West	36°47' N Lat, 114°43' W Long	light reddish brown, thin, wavy-to-lenticular bedded, calcareous mud and weakly cemented sand; a few medium-scale channel bodies of massive sand
5	Glendale Middle	36°43' N Lat, 114°35' W Long	light brown, thickly crossbedded fine sand with internal reverse-graded lamination (eolian), grading upwards to horizontally bedded, calcareous, bioturbated mud, that then coarsens upwards to gray, medium, lenticular beds of sand and imbricated pebble gravel
6	Glendale East	36°42' N Lat, 114°31' W Long	pink, massive to thickly bedded, heavily bioturbated, calcareous sand with root traces and calcareous root casts
7	Overton	36°35' N Lat, 114°25' W Long	light reddish brown, thin-to-medium lenticular beds of trough crossbedded sand with few pebbly gravel lenses and mud intraclasts, interbedded with muddy sand; some medium crossbedded sand with internal coarsening-upwards lamination (eolian) at base
8	Mormon Mesa	36°36' N Lat, 114°22' W Long	light brown, medium lenticular beds of trough crossbedded pebbly sand and imbricated sandy pebble gravel with mud intraclasts, interbedded with minor ripple-cross-stratified to massive sandy mud
9	Riverside	36°46' N Lat, 114°15' W Long	light brown to white, medium lenticular beds of massive or trough-crossbedded, fine-to-medium sand, interbedded with red, massive to laminated mud; few crossbedded sandy pebble-gravel lenses near top
10	Flat Top Mesa	36°47' N Lat, 114°09' W Long	light reddish brown, thin to medium trough crossbedded, normally graded, fine pebbly sand to fine sand with mud intraclasts, interbedded with a few thin, tabular beds of mud
11	Littlefield	36°54' N Lat, 114°00' W Long	gray, normally graded, medium lenticular beds of pebbly sand that tend to be massive, bioturbated, and have carbonate root casts and nodules; interbedded with light reddish brown, ripple laminated, fine-to-medium sand

[1]characteristic descriptions of upper-middle Muddy Creek Formation

[2]clast counts from gravel at all sites mimic patterns seen in sand petrology shown in figure 3

TABLE DR2. GRAIN-MOUNT PETROGRAPHIC COUNT DATA

Sample[1]	Counts											Percentages										Plotted in Fig. 3A		
Sources	qtz_u[2]	qtz_s[3]	orthoclase	sanidine	plagioclase	Lc[4]	Lv[5]	chert	opaques	other	n	qtz_u	qtz_s	orthoclase	sanadine	plagioclase	Lc	Lv	chert	opaques	other	Q%[6]	Lv+san%	Lc%
CR (Colo. River)	117	178	26	5	2	16	28	24	3	1	400	29.3	44.5	6.5	1.3	0.5	4.0	7.0	6.0	0.8	0.3	85.8	9.6	4.7
VR (Virgin River)	76	206	16	7	13	20	38	7	11	6	400	19.0	51.5	4.0	1.8	3.3	5.0	9.5	1.8	2.8	1.5	81.3	13.0	5.8
LoM (metamorphic)[7]	62	136	16	6	29	43	86	9	0	13	400	15.5	34.0	4.0	1.5	7.3	10.8	21.5	2.3	0.0	3.3	59.5	27.6	12.9
LoC (carbonates)[7]	115	42	7	17	21	1716	54	17	7	4	2000	5.8	2.1	0.4	0.9	1.1	85.8	2.8	0.9	0.4	0.2	8.1	3.8	88.2
Transect sites																								
1	142	56	17	40	11	119	9	6	0	0	400	35.5	14.0	4.3	10.0	2.8	29.8	2.3	1.5	0.0	0.0	54.1	13.4	32.5
2[6]	70	90	33	31	9	671	280	6	2	8	1200	5.8	7.5	2.8	2.6	0.8	55.9	23.3	0.5	0.2	0.7	14.0	27.2	58.8
3[6]	358	86	12	189	46	558	268	50	22	11	1600	22.4	5.4	0.8	11.8	2.9	34.9	16.8	3.1	1.4	0.7	30.4	31.3	38.2
4	105	100	13	47	11	30	57	32	0	5	400	26.3	25.0	3.3	11.8	2.8	7.5	14.3	8.0	0.0	1.3	60.5	30.7	8.8
5	34	31	0	48	29	21	105	0	107	25	400	8.5	7.8	0.0	12.0	7.3	5.3	26.3	0.0	26.8	6.3	27.2	64.0	8.8
6	136	168	21	7	4	10	20	34	0	0	400	34.0	42.0	5.3	1.8	1.0	2.5	5.0	8.5	0.0	0.0	89.1	7.9	2.9
7	91	243	16	8	2	12	14	10	1	3	400	22.8	60.8	4.0	2.0	0.5	3.0	3.5	2.5	0.3	0.8	90.8	6.0	3.3
8	145	147	5	22	8	21	29	23	0	0	400	36.3	36.8	1.3	5.5	2.0	5.3	7.3	5.8	0.0	0.0	80.2	14.0	5.8
9	157	173	3	20	1	5	31	10	0	0	400	39.3	43.3	0.8	5.0	0.3	1.3	7.8	2.5	0.0	0.0	85.5	13.2	1.3
11	62	81	0	43	27	9	154	24	0	0	400	15.5	20.3	0.0	10.8	6.8	2.3	38.5	6.0	0.0	0.0	41.0	56.4	2.6

[1]for site names, coordinates, and sediment descriptions, see Table 1 and text
[2]unstrained quartz
[3]strained quartz
[4]carbonate bedrock lithic grains
[5]volcanic lithic grains
[6]relative percentage of the sum of unstrained quartz (qtz_u) and strained quartz (qtz_s)
[7]sum of three to five samples from same section

TABLE DR3. HEAVY-MINERAL PETROGRAPHIC COUNT DATA

Sample[1]			augite/		enstatite/	epidote/												Plotted on Figs. 3B,C		
Sources	anhydrite	apatite	diopside	biotite	hypersthene	clinozoite	garnet	gypsum	hornblende	muscovite	rutile	sphene	tourmaline	zircon	other[2]	opaques	n[3]	ZTR%[4]	H%[5]	ESx2%[6]
CR (Colo. River)		13		2	9	30	136	64		6	14		73	79	2	1100	428	73.5	0.0	26.5
VR (Virgin River)				66	6	12	78	34	72	2	9		48	97	1	1538	425	61.6	28.8	9.6
LoM (metamorphic)				8			22	11	378	1			2			77	422	0.5	99.5	0.0
LoC (carbonates)	299	21	4	14		30	100		4		13	56	32	79		740	652	41.3	1.3	57.3
LoV (volcanic)				138			24	86	192		2		1	12		666	455	7.0	93.0	0.0
Transect sites																				
1		3		162			68	58	2	15	8	37	37	14	4	550	408	43.7	1.5	54.8
2 [7]		4	29	102		1	129	535	37	40	4	9	24	99		1047	1013	69.0	20.1	10.9
3		32	2	82			6	254		8	1		15	3	3	733	406	100.0	0.0	0.0
5a				16		1	134	183	3	3	9	4	43	10		653	406	82.7	4.0	13.3
5b	60	12		39	15	11	91	105	2	1	5	4	40	26		475	411	68.9	1.9	29.1
5c			131	45			3	33	143	8	1		2	61		1413	427	30.9	69.1	0.0
7		9	1	29			113	85	6	21	3	6	30	111		891	414	88.9	3.7	7.4
8a			4	14			172	39	4		3		62	128		1957	426	98.0	2.0	0.0
8b			2	11			137	97	3	7			53	92		851	402	98.0	2.0	0.0
8c			127	32			117	55	13	10	2		43	26		746	425	84.5	15.5	0.0
9				14			137	82	6	2	1	19	95	49	1	1147	406	76.7	3.2	20.1
10a				17	15		33	378			2		20	19		361	484	100.0	0.0	0.0
10b		3		18	6		17	337	1		3		21	8		248	414	97.0	3.0	0.0
10c				17	24		58	274	20		3	2	20	24		456	442	66.2	28.2	5.6
11		1		98	1		64	133	9	36	12	14	16	18	1	1497	403	55.4	10.8	33.7

[1]for site names, coordinates, and sediment descriptions, see Table 1 and text
[2]chlorite, corundum, olivene, and tremolite all had less than 4 grains in less than 3 samples each
[3]total number of grains not including opaques
[4]relative percent of the sum of zircon, tourmaline and rutile
[5]relative percent of hornblende
[6]relative percent of two times the sum of epidote and sphene
[7]sum of three samples in same section