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Supplementary Information

Uranium Mobility and Accumulation along the Rio Paguate, Jackpile Mine in Laguna Pueblo, New Mexico

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Table S1. Geographical locations and description of sampling sites.

Site ID	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Latitude	35.15966	35.15588	35.15667	35.1531	35.14098	35.15192	35.13252	35.12331	35.11758	35.11279	35.11868	35.10284	35.1021	35.08900	35.08359	35.07462	35.06
Longitude	-107.427	-107.427	-107.414	-107.399	-107.383	-107.357	-107.3449	-107.337	-107.333	-107.331	-107.3328	-107.3249	-107.3253	-107.3219	-107.3267	-107.332	-107.332
Description	Background	Background	Background	Background	Background	Rio Moquino	Below Confluence	Jackpile above bridge	Below Bridge	Below mine	Below mine	Near cotton woods	Near cotton woods	Graze area	Above wetland	Wetland above reservoir	Paguate Reservoir

Table S2. Additional XRF Data

Sample Location	U (mg/kg)	As (mg/kg)	Fe (mg/kg)	Mn (mg/kg)	P (mg/kg)	S (mg/kg)	V (mg/kg)	Na (mg/kg)	Mg (mg/kg)	Al (mg/kg)	Ca (mg/kg)	Cr (mg/kg)	Pb (mg/kg)
Laguna Ore Lens	9,300	*BDL*[*]	109,000	1,900	2,600	4,900	660	5,700	21,000	64,000	52,000	270	340
Sediment Below Ore Lens	1,400	58.0	13,000	*BDL*	380	2,900	140	610	1,200	30,000	3,300	*BDL*	*BDL*
Sediment Below Ore Lens	320	*BDL*	18,000	500	370	2,800	150	5,200	59,000	52,000	6,200	140	*BDL*
Stop 1- Stream Bank	*BDL*	*BDL*	106,000	1,600	2,800	702	*BDL*	8,400	10,000	66,000	110,000	880	*BDL*
Stop 1- Stream Bed	*BDL*	*BDL*	30,000	360	790	1,600	*BDL*	2,900	5,400	38,000	42,000	190	*BDL*
Stop 9- Stream Bank	*BDL*	*BDL*	38,000	670	1,000	4,500	*BDL*	1,500	5,900	51,000	84,000	1,200	*BDL*
Stop 9- Stream Bed	*BDL*	*BDL*	33,000	305	1,000	2,900	*BDL*	1,200	4,700	56,000	14,000	700	*BDL*

* BDL = Below detection limit. Note that the detection limits of XRF for different elements are 60 mg/kg for U, 40 mg/kg for As, 100 mg/kg for Fe, 100 mg/kg for Mn, 100 mg/kg for V, and 100 mg/kg for Pb.

Table S3. Additional Water Chemistry Data

Date	Site #	pH	As (ug/L)	U (ug/L)	Cr (ug/L)	Pb (ug/L)	Fe (ug/L)	Al (mg/L)	Ca (mg/L)	K (mg/L)	Mg (mg/L)	Na (mg/L)	Cl (mg/L)	NO3 (mg/L)	SO4 (mg/L)	Alkalinity as CaCO3 (mg/L)	TOC (mg/L)
9/17/2014	1	8.17	1.30	711	9.95	BDL*	476	BDL	175	7.11	--	--	--	--	--	--	--
11/13/2014	-6	8.33	1.33	0.784	0.069	BDL	127	BDL	30.2	4.16	14.3	12.5	4.95	0.784	9.90	141	1.90
	-5	8.21	1.21	0.796	0.097	BDL	137	BDL	30.6	4.03	14.0	13.4	5.09	1.69	12.5	148	1.99
	-4	--	1.40	0.921	0.149	BDL	158	BDL	34.0	4.36	15.3	14.9	4.93	BDL	18.3	155	2.65
	-3	--	1.36	0.404	0.116	BDL	158	BDL	36.7	4.35	15.6	15.7	5.01	BDL	22.4	160	2.54
	-2	--	1.45	0.651	0.154	BDL	168	BDL	40.6	4.37	16.8	16.7	5.29	BDL	22.3	164	2.87
	-1	8.58	0.56	7.97	5.46	BDL	657	BDL	190	11.1	80.5	224	21.7	0.117	1256	182	7.04
	1	8.27	1.41	131	2.30	BDL	438	BDL	112	6.62	64.5	93.1	9.74	0.118	484	276	3.63
	2	6.81	1.59	128	2.37	BDL	433	BDL	113	6.80	66.0	97.6	13.5	0.372	505	276	3.27
	3	7.80	1.45	123	2.32	BDL	390	BDL	113	6.90	66.1	97.9	13.2	0.158	504	283	3.71
	9	--	0.997	5.77	1.76	BDL	464	BDL	136	11.6	29.4	42.1	9.56	0.327	556	136	8.66
	10	--	1.77	6.40	3.02	BDL	541	BDL	164	15.2	43.1	72.5	12.6	0.148	637	70.4	10.5
2/23/2015	1	7.56	2.33	35.3	0.200	2.34	--	0.376	13.1	1.08	25.9	17.9	1.86	BDL	108	256	1.89
	2	7.56	2.56	35.9	BDL	1.80	--	0.537	123	7.52	85.2	124	1.82	BDL	107	268	2.28
	3	7.58	2.50	38.6	BDL	1.66	--	0.533	122	7.31	85.4	120	1.91	BDL	111	264	1.77
	4	7.21	2.55	39.7	BDL	1.74	--	0.524	123	7.31	85.7	119	0.080	BDL	3.58	272	1.59
	5	6.83	2.35	39.8	3.77	2.14	--	0.630	127	7.43	88.7	127	1.01	BDL	53.4	248	1.03
	6	7.19	2.23	39.0	BDL	3.49	--	0.586	127	7.45	89.0	126	1.93	BDL	114	116	1.52

	7	7.07	2.58	36.9	BDL	2.15	--	0.521	121	7.19	87.5	123	2.00	BDL	114	236	1.65
	8	7.50	2.70	36.6	BDL	2.32	--	0.515	116	7.50	83.8	121	1.95	0.136	112	244	2.23
	9	6.99	2.16	27.0	BDL	1.74	--	0.585	160	15.4	83.5	161	2.70	0.055	170	152	6.66
	10	7.91	2.44	5.46	BDL	1.86	--	0.378	47.7	5.60	20.0	27.8	3.04	BDL	146	192	14.0
3/11/2015	0	7.71	--	7.28	BDL	BDL	--	2.91	115	7.95	86.0	125	2.00	0.167	113	328	4.64
	1	7.73	--	68.8	2.57	1.56	--	0.454	150	7.71	81.4	106	16.4	39.2	504	72.0	2.59
	5	7.50	--	83.1	BDL	BDL	--	0.329	7.72	0.763	19.6	13.1	22.8	BDL	852	44.0	2.93
	7	8.33	--	72.1	BDL	BDL	--	0.505	175	8.49	108	176	19.3	BDL	860	48.0	2.33
5/11/2015	1	8.05	9.25	148	--	--	2340	BDL	164	7.77	21.8	188	17.9	BDL	608	305	--
	3	8.46	11.6	132	--	--	1873	BDL	126	7.07	21.8	157	15.4	BDL	1040	262	--
	10	8.29	12.0	76.5	--	--	2197	BDL	169	12.7	7.39	218	22.3	BDL	862	304	--
6/17/2015	1	8.08	1.95	170	--	--	2107	BDL	167	8.90	117	158	6.33	13.9	1084	318	--
8/14/2015	1	8.08	3.41	341	--	--	--	BDL	234	10.4	179	286	30.5	BDL	2080	372	--
	5	8.16	2.40	301	--	--	--	BDL	195	10.9	162	253	29.1	BDL	1901	248	--
	9	7.72	3.51	110	--	--	--	BDL	166	13.5	50.4	86.3	15.5	BDL	655	236	--
	10	7.34	1.85	13.9	--	--	--	BDL	135	11.5	26.9	48.4	17.2	BDL	423	156	--
9/23/2015	1	7.78	32.1	75.3	--	--	5174	0.320	275	12.5	68.3	1070	16.2	8.17	1305	137	--
	5	8.08	24.5	41.3	--	--	5454	0.321	278	12.5	55.8	909	15.4	10.8	753	103	--
	9	8.03	17.1	23.6	--	--	3900	0.338	208	18.1	61.6	1093	20.4	4.40	1054	119	--

	10	7.06	24.1	7.36	--	--	2650	0.355	139	11.4	30.1	580	16.0	4.65	444	180	--
5/11/2016	1	8.02	7.18	290	0.33	4.55	4881	BDL	197	--	78.3	255	--	--	--	--	--
	-1	8.30	5.20	7.76	7.78	4.45	3347	BDL	132	--	70.4	255	--	--	--	--	--
	10	8.10	2.01	28.4	1.41	5.36	5307	BDL	204	--	52.9	148	--	--	--	--	--
6/3/2016	1	8.08	3.82	373	14.4	5.66	6874	BDL	194	--	80.7	289	--	--	--	--	--
	10	7.13	3.25	30.5	2.14	5.64	4734	BDL	179	--	54.8	167	--	--	--	--	--
7/25/2016	1	8.16	14.4	772	5.12	5.80	5563	BDL	194	--	89.4	480	--	--	--	--	--
	10	7.37	10.1	21.9	0.71	5.76	5509	BDL	192	--	89.9	488	--	--	--	--	--
8/18/2016	1	8.06	7.04	286	1.28	4.52	4133	BDL	145	--	66.4	202	--	--	--	--	--

* BDL = Below detection limit. Note that the detection limit of ICP-MS is 0.01 µg/L Cr, 0.0004 µg/L Pb. The detection limit of Al on ICP-OES is 0.280 mg/L and the detection limit of NO_3^- on IC is 0.100 mg/L

Table S4. Aqueous complexes seasonally from Site 1 and Site 9

	Total Uranium (mol/L)	**$Ca_2UO_2(CO_3)_3$**	**$CaUO_2(CO_3)_3$**	**$UO_2(CO_3)_3^{-4}$**	**$UO_2(CO_3)_2^{-2}$**
9/14 Site 1	2.99E-06	1.31E-06	3.08E-07	2.00E-09	2.51E-09
11/14 Site 1	5.52E-07	3.11E-07	2.32E-07	6.83E-09	1.89E-09
2/15 Site 1	1.48E-07	4.77E-08	9.22E-08	4.78E-09	3.13E-09
5/15 Site 1	6.23E-07	4.21E-07	1.96E-07	4.18E-09	1.60E-09
8/15 Site 1	1.43E-06	9.29E-07	4.78E-07	1.86E-08	3.89E-09
11/14 Site 9	2.42E-08	1.55E-08	5.34E-09	7.69E-11	1.21E-09
2/15 Site 9	1.13E-07	9.14E-08	2.03E-08	1.79E-10	7.66E-10
5/15 Site 10	3.21E-07	2.01E-07	1.16E-07	3.41E-09	9.41E-10
8/15 Site 9	4.64E-07	3.51E-07	1.11E-07	1.60E-09	9.03E-10

Table S5. Microbial results.

See Excel File.

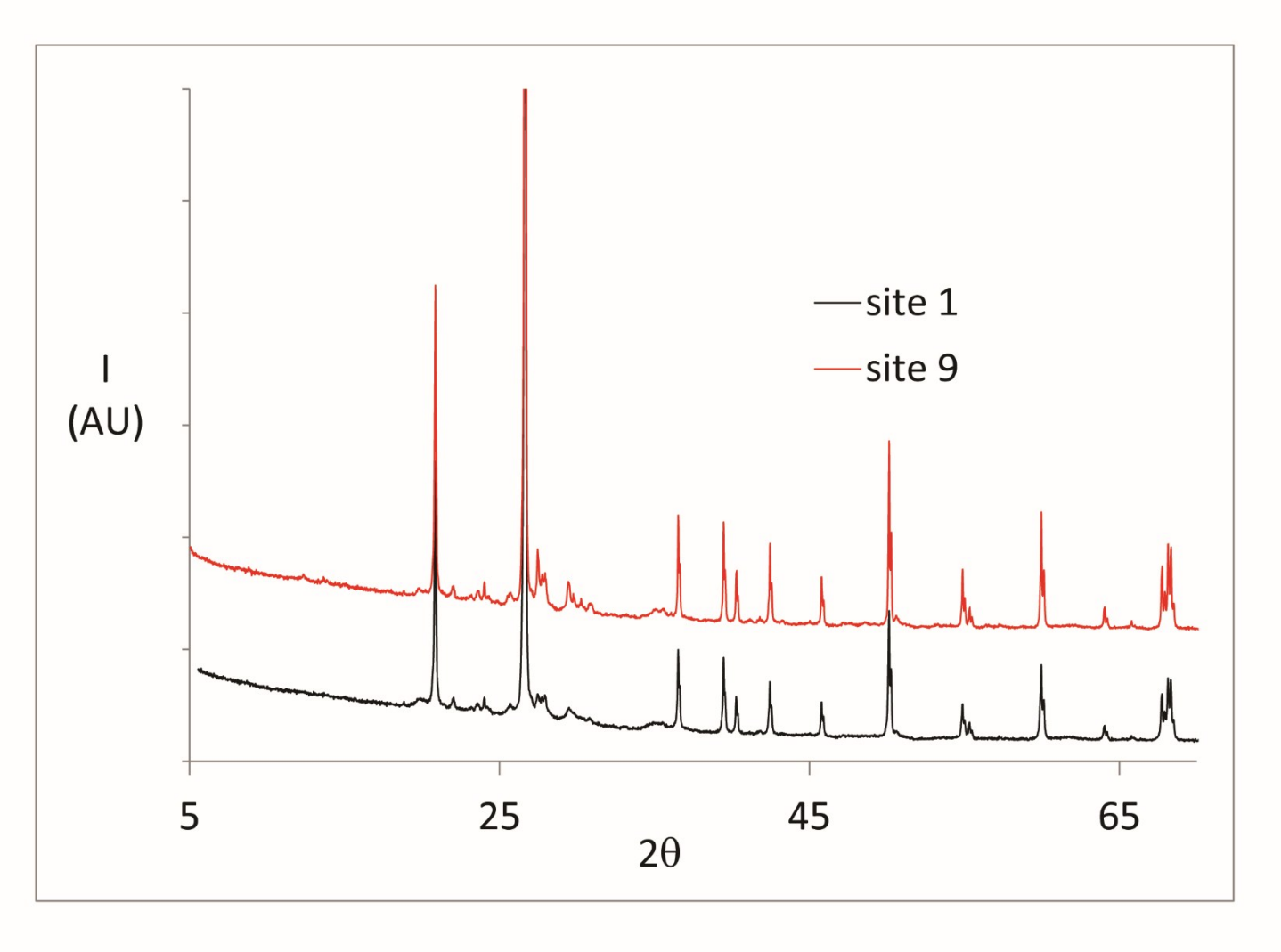

Figure S1. XRD peak comparison of Site 1 and Site 9.

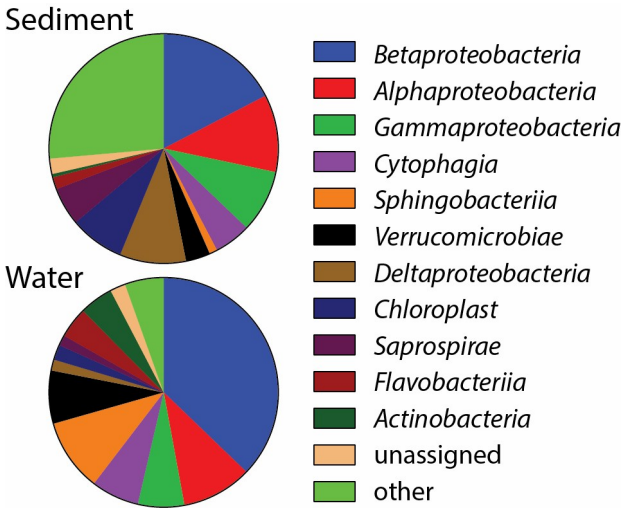

Figure S2. Distribution of 16S rRNA sequences classified within classes of Bacteria. For clarity, only classes with an average relative abundance >2% are specifically identified. Those classes with <2% relative abundance are lumped within the category "other".