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Mineral and chemical compositions of authigenic clay minerals in the Morrison Formation, southern San Juan Basin, New Mexico

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INTRODUCTION

The samples described in this paper are from drill cores collected during the Mariano Lake - Lake Valley Drilling Project, which was completed under the supervision of the U.S. Geological Survey in 1980. Lithologic descriptions of all cores and cuttings retrieved during drilling may be found in Huffman and others (1981a, b), Kirk and others (1981a, b, c, d), and Zech and others (1981a, b). Samples from sandstones were taken from cores 1, 3, 4, 5, 6, and 7 (S1, S3, etc.). The purpose for studying the clay minerals in these rocks was to gain an understanding of the regional and local variations in the mineralogy and geochemistry of authigenic and diagenetic clay minerals as an independent means of assessing the hydrogeochemical regime that was responsible for the emplacement of the sandstone-hosted uranium deposits in the southern San Juan Basin. An interim report on the results of this study is in Whitney (1985), and details of the paleohydrology (regional) and the ore-forming processes (local) are being prepared for publication in subsequent reports. The present paper contains the raw data set upon which the other reports are based. The samples used for this study are, in many cases, splits of the same samples examined by Steele (1984) and by Hansley (1983 and in press) in studies of the sandstone petrology and the study of heavy minerals.

GEOGRAPHIC AND GEOLOGIC SETTING

The cores from which these clay samples were taken come from a line of drill holes that lies along a roughly north-south line at the southern margin of the San Juan Basin (fig. 1). The core fence traverses the western end of the Grants uranium region (GUR), and several of the drill holes penetrated subsurface ore-grade mineralization. The lower numbered cores are nearer to the edge of the basin and the higher numbered cores lie basinward, so that the cored interval represents greater depth as the core numbers increase.

The cored interval includes the Upper Jurassic Morrison Formation, consisting of (in descending order) the Brushy Basin Member, the Westwater Canyon Member, and the Recapture Member. The Brushy Basin Member is composed of bentonitic claystone and mudstone units with sandstone lenses and stringers; both the Westwater Canyon and Recapture Members are primarily sandstone. However, sandstones in the Westwater are generally medium grained, whereas those in the Recapture are fine-grained (Steele, 1984).

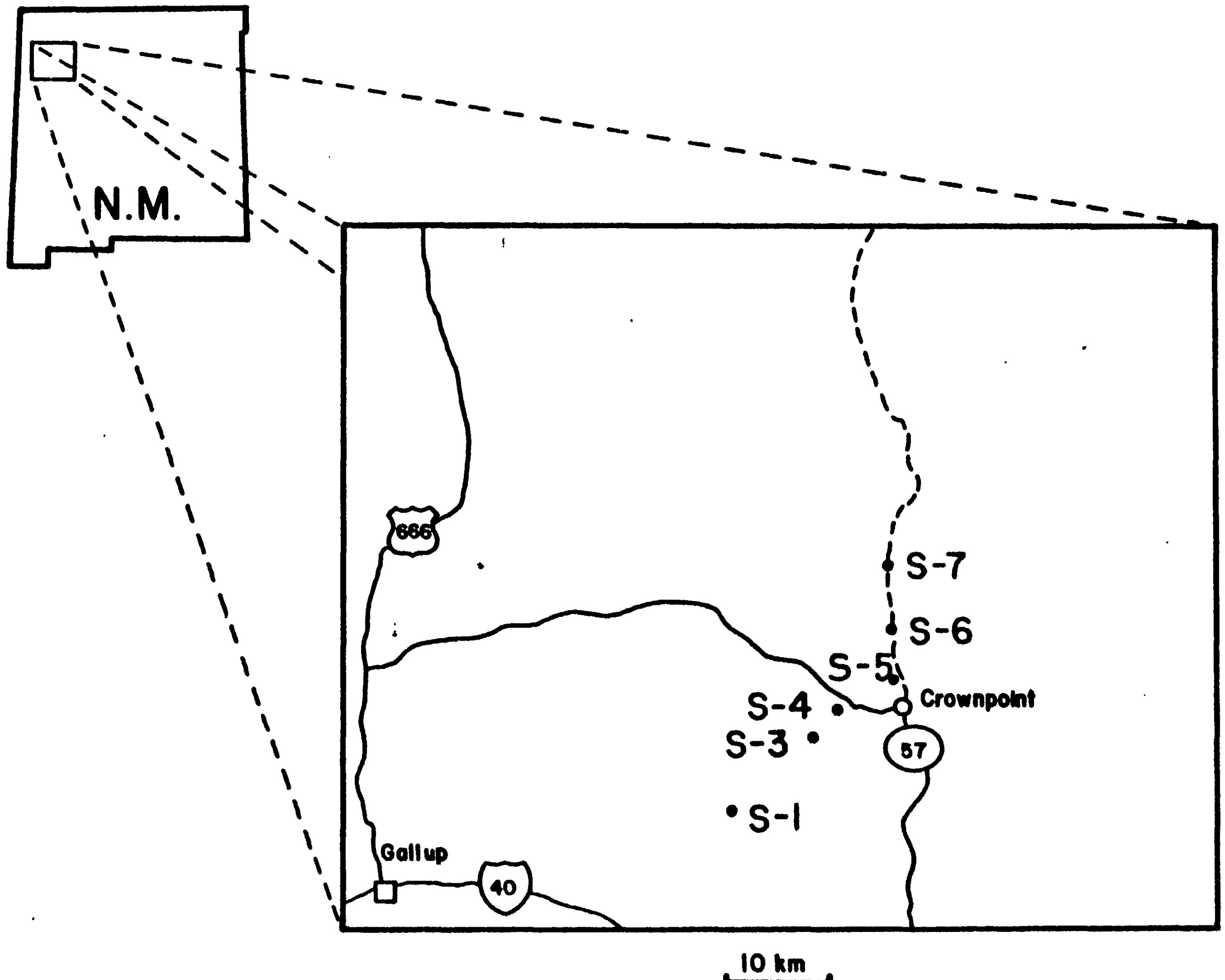

Figure 1. Location map for cores sampled for this study.

The emphasis during this sampling program was to collect core from the Westwater Canyon Member because virtually all uranium mineralization lies within this unit.

Only sandstones were sampled for this study, and the clay minerals studied were all authigenic. No effort was made to examine the detrital clay mineralogy.

ANALYTICAL TECHNIQUES

Core samples were crushed in a jaw crusher to pea-sized chunks, placed in a beaker with distilled water, and disaggregated ultrasonically for ten minutes. Having thus separated the clays from sand grains, the clays were elutriated, dispersed, and centrifuged to separate the <1 μm fraction for analysis. All the mineralogical and chemical data in this paper represent the <1 μm fraction.

The mineral composition was determined by orienting the clays on glass slides using the modified membrane filtration technique of Pollastro (1982). Samples were analyzed by X-ray diffraction after various treatments: air-drying, saturation with ethylene glycol, and heating to 550°C. The relative abundance of the different clay minerals in each sample was determined by using a normalized peak intensity technique similar to that described by Schultz (1964). These results are only semiquantitative, but are intended to give an internally consistent data set that can be used for outlining trends and making correlations. The semiquantitative clay mineralogy is listed in table 1.

For chemical analysis, the samples were air-dried, digested in hydrofluoric acid, and the major elements (except silicon) were determined using inductively coupled plasma emission spectroscopy. Silicon was not determined because of quartz contamination in some of the samples, and because the hydrofluoric acid digestion volatolizes the silicon.

The results of the major element chemical analysis are listed in table 2, and selected trace element analyses for ore zone samples are in table 3. All numbers are given in percent of the element (not the oxide) for the majors or in parts per million (ppm) for the trace elements. Sample numbers listed represent the core number and the depth (in feet). For example, sample S1-541 is from core number one and from a depth of 541 feet.

Table 1. --Relative abundance of authigenic clay minerals in the < 1 μm fraction of core 1 samples from the Morrison Formation Mariano Lake - Lake Valley Drilling Project

Member	Sample	Clay composition (%) Smectite	Illite	Chlorite	Kaolinite	I/S
Jmb	S1-541	95	0	0	5	0
	S1-561	85	0	10	5	0
	S1-594	90	0	10	0	0
	S1-608	70	0	25	0	0
	S1-615	85	0	10	5	0
	S1-636	80	0	10	5	0
	S1-640	70	0	20	10	0
	S1-667	70	0	20	10	0
	S1-677	75	0	15	10	0
	S1-726	75	0	15	10	0
Jmw	S1-731	95	0	0	5	0
	S1-734	95	0	0	5	0
	S1-738	75	0	20	5	0
	S1-747	75	0	15	10	0
	S1-782	60	0	30	10	0
	S1-784	90	0	5	5	0
	S1-810	90	0	5	5	0
	S1-818	70	0	20	10	0
	S1-861	90	0	5	5	0
	S1-866	90	5	0	5	0
	S1-881	95	0	5	0	0
	S1-891	85	0	10	5	0
Jmr	S1-918A	95	0	0	0	5
	S1-918B	95	0	5	0	0
	S1-930	95	0	5	0	0
	S1-950	90	0	5	5	0
	S1-1063	60	0	5	15	20

Jmb = Brushy Basin Member, Morrison Formation
Jmw = Westwater Canyon Member, Morrison Formation
Jmr = Recapture Member, Morrison Formation
I/S = interstratified illite/smectite
* = ore zone sample

Table 1. --Relative abundance of authigenic clay minerals in the < 1 µm fraction of core 3 samples from the Morrison Formation Mariano Lake - Lake Valley Drilling Project (continued)

		Clay composition (%)				
Member	Sample	Smectite	Illite	Chlorite	Kaolinite	I/S
Jmb	S3-1645	95	0	0	5	0
	S3-1679	90	0	0	5	5
	S3-1687	95	0	0	0	5
	S3-1715	80	0	0	5	15
Jmw	S3-1783	0	0	45	20	35
	S3-1798	0	0	50	20	30
	S3-1807	0	0	40	20	40
	S3-1812A	0	0	30	10	60
	S3-1812B	0	0	30	5	65
	S3-1812C	0	0	30	5	65
	S3-1833	0	0	30	10	60
	S3-1863*	0	0	50	10	40
	S3-1866*	0	0	50	10	40
	S3-1867*	0	0	45	10	45
	S3-1874	0	0	35	15	50
	S3-1882	0	0	40	10	50
	S3-1905	0	0	20	10	70
	S3-1916	0	0	30	10	60
	S3-1924	0	0	15	5	80
	S3-1939	0	0	5	5	90
	S3-1957	0	0	15	10	75
	S3-1967	0	0	40	10	50
	S3-1986	0	0	15	5	80
	S3-2016	90	5	5	0	0
Jmr	S3-2042	90	5	5	0	0
	S3-2074	95	0	5	0	0
	S3-2113	90	5	5	0	0

Table 1. --Relative abundance of authigenic clay minerals in the < 1 μm fraction of core 4 samples from the Morrison Formation Mariano Lake - Lake Valley Drilling Project (continued)

		Clay composition (%)				
Member	Sample	Smectite	Illite	Chlorite	Kaolinite	I/S
	S4-1779	90	5	0	5	0
Jmb	S4-1807	90	5	0	5	0
	S4-1817	90	0	5	5	0
	S4-1878	0	0	15	5	80
	S4-1900	0	0	10	10	80
	S4-1910*	0	0	40	20	40
	S4-1928*	10	0	50	40	0
	S4-1939*	20	0	30	50	0
	S4-1960	0	0	40	30	30
	S4-1971	0	0	50	40	10
Jmw	S4-1998	0	0	40	10	50
	S4-2010	0	0	50	10	40
	S4-2030	0	0	40	10	50
	S4-2055	0	0	50	20	30
	S4-2087	0	0	40	20	40
	S4-2123	0	0	30	5	65
	S4-2137	0	0	15	5	80
	S4-2159	0	5	30	10	55
	S4-2204	50	0	25	5	20
Jmr	S4-2239	80	0	10	5	5
	S4-2265	85	0	15	0	0
	S4-2293	80	0	10	0	10

Table 1. --Relative abundance of authigenic clay minerals in the < 1 μm fraction of core 5 samples from the Morrison Formation Mariano Lake - Lake Valley Drilling Project (continued)

Member	Sample	Clay composition (%)				
		Smectite	Illite	Chlorite	Kaolinite	I/S
Jmb	S5-2323	95	0	0	5	0
	S5-2359	50	0	20	20	10
	S5-2425	0	0	10	20	70
	S5-2439	10	0	30	40	20
	S5-2477	0	0	40	30	30
	S5-2510	0	0	40	30	30
	S5-2519	0	0	10	10	80
	S5-2533	0	0	20	30	50
Jmw	S5-2587	0	0	20	30	50
	S5-2622	0	0	30	30	40
	S5-2653	0	0	30	30	40
	S5-2683	0	0	10	15	75
	S5-2698	0	0	40	20	40
	S5-2736	0	0	0	10	90
	S5-2759	0	0	40	20	40
	S5-2785	0	0	20	10	70
	S5-2824	90	0	0	0	10
Jmr	S5-2849	95	0	0	5	0

Table 1. --Relative abundance of authigenic clay minerals in the < 1 μm fraction of core 6 samples from the Morrison Formation Mariano Lake - Lake Valley Drilling Project (continued)

		Clay composition (%)				
Member	Sample	Smectite	Illite	Chlorite	Kaolinite	I/S
	S6-2565	0	0	0	5	95
	S6-2566.5	0	0	0	5	95
Jmw	S6-2567.5	0	0	0	5	95
	S6-2657.5	0	0	5	5	90
	S6-2724	0	0	5	5	90
Jmr	S6-2892	0	0	5	25	70

Table 1. --Relative abundance of authigenic clay minerals in the < 1 μm fraction of core 7 samples from the Morrison Formation Mariano Lake - Lake Valley Drilling Project (continued)

		Clay composition (%)				
Member	Sample	Smectite	Illite	Chlorite	Kaolinite	I/S
	S7-2855	80	0	15	5	0
	S7-2896	90	0	0	5	5
Jmb	S7-2911	85	0	0	5	10
	S7-2941	95	0	5	0	0
	S7-2978	80	0	5	5	10
	S7-3013	90	0	0	5	5
	S7-3038	0	0	15	10	75
	S7-3051	0	5	35	0	60
	S7-3068	0	5	60	0	35
	S7-3091	0	5	50	0	45
	S7-3133	0	0	60	0	40
Jmw	S7-3155	0	0	70	0	30
	S7-3190	0	0	50	0	50
	S7-3195	0	0	70	0	30
	S7-3213	0	0	70	0	30
	S7-3223*	0	0	70	0	30
	S7-3247*	0	0	50	0	50
	S7-3267*	0	0	50	0	50
	S7-3272	0	0	50	0	50
	S7-3282	0	0	20	0	80
	S7-3296	0	0	40	0	60
	S7-3300	0	0	20	0	80
	S7-3302	0	0	30	0	70
	S7-3302.5	0	0	40	0	60
	S7-3320	70	0	20	0	10
	S7-3336	70	0	20	0	10
	S7-3358	70	0	20	5	5
	S7-3374	60	0	20	10	10
	S7-3388	60	0	20	10	10
	S7-3400	90	0	5	5	0
Jmr	S7-3420	90	0	0	0	5
	S7-3438	90	0	0	0	5

Table 2. --Elemental Concentration in the < 1μm Fraction of Core 1 Samples from the Mariano Lake - Lake Valley Drilling Project

Member	Sample	Al %	Ca %	Fe %	K %	Mg %	Na %	Ti %
Jmb	S1-541	10.8	1.68	2.62	0.86	1.81	0.06	0.30
	S1-559	11.4	1.54	2.29	1.08	1.72	0.10	0.36
	S1-561	10.6	1.41	6.95	0.63	2.10	0.48	0.25
	S1-594	10.3	1.29	5.28	1.17	2.10	0.22	0.43
	S1-608	9.98	1.03	8.17	1.80	2.46	0.18	0.44
	S1-615	17.4	2.18	7.61	1.60	3.60	0.19	0.73
	S1-636	10.9	1.40	5.40	0.70	2.08	0.64	0.29
	S1-640	10.7	1.37	6.00	0.5	2.18	0.83	0.25
	S1-667	10.5	1.62	6.09	0.4	2.23	0.88	0.19
	S1-677	10.3	1.49	5.31	0.5	1.99	0.27	0.20
Jmw	S1-726	10.3	1.39	7.16	1.1	2.26	0.31	0.23
	S1-731	11.4	1.46	3.29	1.6	1.87	0.07	0.32
	S1-734	11.1	1.55	4.06	1.1	1.79	0.09	0.28
	S1-738	6.67	0.68	4.25	1.1	1.46	0.40	0.25
	S1-747	9.46	1.16	5.00	0.7	1.94	0.41	0.19
	S1-782	10.8	1.43	6.56	0.6	2.20	0.49	0.21
	S1-784	11.8	1.54	5.11	1.3	2.06	0.16	0.41
	S1-810	11.6	1.36	4.32	1.8	2.02	0.09	0.25
	S1-818	11.1	1.31	8.83	0.6	2.59	0.17	0.12
	S1-861	11.4	1.56	2.99	1.0	1.85	0.35	0.51
	S1-866	11.4	1.61	3.08	2.4	1.99	0.35	0.45
	S1-881	11.2	1.36	3.38	1.0	2.08	0.27	0.32
	S1-891	11.0	1.40	3.19	0.3	1.90	0.34	0.40
Jmr	S1-918A	11.0	1.63	1.63	0.9	1.78	0.33	0.16
	S1-918B	11.6	1.53	1.73	1.0	1.91	0.31	0.16
	S1-930	8.48	6.78	1.35	1.0	1.13	1.55	0.10
	S1-950	12.2	1.72	1.84	0.6	1.91	0.40	0.17
	S1-1063	11.9	0.82	4.66	2.6	2.80	0.33	0.41

Table 2. --Elemental Concentration in the < 1µm Fraction of Core 3 Samples from the Mariano Lake - Lake Valley Drilling Project (continued)

Member	Sample	Al %	Ca %	Fe %	K %	Mg %	Na %	Ti %
	S3-1645	12.6	1.34	2.05	0.91	1.09	0.86	0.28
	S3-1679	11.8	1.38	1.96	1.03	1.37	0.86	0.19
Jmb	S3-1687	12.5	1.48	2.62	1.66	1.58	0.85	0.30
	S3-1715	10.7	0.78	2.78	3.20	1.47	0.47	0.34
	S3-1783	9.98	2.59	9.52	1.4	2.06	3.95	0.57
	S3-1798	9.26	0.71	7.32	1.6	1.97	5.60	0.34
	S3-1807	9.16	0.62	4.70	2.84	1.30	6.09	0.37
	S3-1812A	11.7	0.98	4.64	3.46	1.86	0.29	0.69
	S3-1812B	11.7	0.94	4.21	3.60	1.79	0.24	0.61
	S3-1812C	11.8	0.96	3.73	3.77	1.73	0.26	0.63
	S3-1812D	11.6	0.97	3.95	3.62	1.76	0.26	0.67
	S3-1833	11.4	0.82	5.48	2.30	1.65	3.60	0.18
	S3-1863*	11.0	0.54	7.37	2.58	1.91	3.67	0.21
	S3-1864*	11.2	0.33	11.9	1.73	2.55	4.24	0.14
	S3-1866*	10.5	0.83	7.01	2.37	1.77	5.24	0.68
	S3-1867*	11.0	0.68	8.03	2.33	1.95	4.31	0.77
Jmw	S3-1874	11.2	0.32	5.33	2.60	1.60	5.33	0.31
	S3-1882	12.4	0.40	7.87	2.69	2.02	1.52	0.73
	S3-1905	12.6	0.44	5.37	3.38	1.70	1.57	0.46
	S3-1916	11.7	0.30	6.37	3.12	1.69	4.19	1.17
	S3-1939	10.8	0.60	6.19	4.45	1.47	0.30	0.45
	S3-1957	12.5	0.36	5.96	2.87	1.81	2.20	0.56
	S3-1967	11.3	0.44	7.19	2.45	1.93	4.42	0.67
	S3-1978	12.5	0.57	5.74	3.65	1.94	0.47	0.43
	S3-1986	12.7	0.83	6.23	2.43	1.99	0.81	0.81
	S3-1962	12.9	0.42	6.08	3.22	1.84	1.63	0.41
	S3-2016	12.1	1.16	2.74	2.11	1.57	0.49	0.30
	S3-2042	12.6	1.22	3.29	1.18	1.67	0.70	0.39
Jmr	S3-2074	12.8	1.37	1.99	0.76	1.56	0.81	0.37
	S3-2101	12.3	1.21	1.82	1.87	1.82	0.63	0.23
	S3-2113	12.3	1.18	1.82	1.82	1.82	0.72	0.29

Table 2. --Elemental Concentration in the < 1μm Fraction of Core 4 Samples from the Mariano Lake - Lake Valley Drilling Project (continued)

Member	Sample	Al %	Ca %	Fe %	K %	Mg %	Na %	Ti %
	S4-1779	11.8	0.92	1.90	1.02	1.04	0.71	0.30
Jmb	S4-1807	11.3	1.34	2.04	0.90	1.28	0.50	0.23
	S4-1817	11.1	0.78	2.76	1.64	1.51	0.86	0.16
	S4-1878	10.4	0.68	3.60	2.6	1.75	0.49	0.56
	S4-1900	11.1	1.7	3.6	<2.	2.4	1.8	1.2
	S4-1910*	10.8	0.9	5.7	<2.	2.3	0.9	0.5
	S4-1928*	12.4	0.55	13.7	<1.	4.17	0.73	0.26
	S4-1939*	16.3	1.00	9.21	1.3	3.42	1.27	0.52
	S4-1960	11.4	0.9	5.3	<3.	2.1	0.7	0.9
	S4-1971	12.8	0.4	16.1	<3.	4.4	0.3	0.5
Jmw	S4-1998	13.6	0.90	5.00	2.6	2.13	0.79	0.44
	S4-2010	11.6	0.52	10.2	1.6	3.02	1.11	0.88
	S4-2030	11.5	0.8	6.6	2.0	2.3	1.6	0.4
	S4-2055	12.2	2.5	6.1	<2.	2.4	1.7	0.7
	S4-2087	12.0	1.0	5.3	2.0	1.9	1.3	0.2
	S4-2123	13.7	0.91	4.81	3.0	2.21	1.02	0.44
	S4-2137	12.5	0.78	3.81	3.1	1.62	0.42	0.32
	S4-2159	12.7	1.13	3.86	2.6	1.97	1.49	0.37
	S4-2204	13.5	1.30	3.93	2.2	2.13	0.64	0.36
Jmr	S4-2239	12.6	1.12	2.63	0.7	1.83	0.70	0.25
	S4-2265	12.4	1.16	3.13	0.9	1.90	0.74	0.22
	S4-2293	11.9	2.52	2.63	2.0	2.29	0.42	0.24

Table 2. --Elemental Concentration in the < 1μm Fraction of Core 5 Samples from the Mariano Lake - Lake Valley Drilling Project (continued)

Member	Sample	Al %	Ca %	Fe %	K %	Mg %	Na %	Ti %
Jmb	S5-2323	13.4	1.03	2.27	1.7	1.17	0.51	0.18
	S5-2359	14.0	1.4	3.6	<5.	4.9	2.0	<0.5
	S5-2425	12.0	0.53	2.99	3.5	1.72	0.31	0.91
	S5-2439	11.0	1.2	4.0	<3.	2.7	5.6	0.7
	S5-2477	11.4	0.46	7.47	2.4	2.36	0.95	0.74
	S5-2510	11.1	1.0	6.8	3.0	3.1	2.3	0.9
	S5-2519	10.1	0.36	3.42	3.42	1.63	0.64	0.19
Jmw	S5-2533	12.4	0.71	3.54	3.2	1.90	1.96	0.38
	S5-2587	11.8	0.76	3.28	2.9	1.67	3.52	0.82
	S5-2622	11.5	0.7	5.0	3.0	2.1	2.5	0.5
	S5-2628	12.0	0.53	3.21	3.78	1.46	0.18	0.23
	S5-2653	11.4	0.59	4.10	2.2	1.64	2.81	0.58
	S5-2683	12.9	0.86	4.00	3.2	1.57	2.06	0.32
	S5-2698	11.8	0.64	6.05	2.9	1.81	2.03	0.57
	S5-2736	11.9	0.65	5.70	3.53	1.57	0.17	0.26
	S5-2759	12.6	2.9	7.6	<5.	2.5	<0.5	<0.5
Jmr	S5-2824	11.7	1.57	1.07	1.02	1.64	0.49	0.18
	S5-2849	12.5	1.85	1.24	0.8	1.90	0.09	0.13

Table 2. --Elemental Concentration in the < 1μm Fraction of Core 6 Samples from the Mariano Lake - Lake Valley Drilling Project (continued)

Member	Sample	Al %	Ca %	Fe %	K %	Mg %	Na %	Ti %
	S6-2565	11.3	0.45	2.74	2.91	1.42	0.28	0.20
	S6-2565	13.0	0.53	3.09	3.50	1.60	0.35	0.20
	S6-2566.5	12.2	0.46	3.77	3.56	1.52	0.28	0.21
Jmw	S6-2567.5	13.3	0.47	3.11	3.38	1.44	0.33	0.21
	S6-2657.5	13.0	0.53	2.89	3.52	1.69	0.24	0.26
	S6-2724	11.5	0.52	3.18	3.06	1.39	0.57	0.21
Jmr	S6-2892	11.6	0.92	8.11	2.55	1.66	0.34	0.25

Table 2. --Elemental Concentration in the < 1μm Fraction of Core 7 Samples from the Mariano Lake - Lake Valley Drilling Project (continued)

Member	Sample	Al %	Ca %	Fe %	K %	Mg %	Na %	Ti %
	S7-2855	14.7	1.53	3.34	0.15	0.87	0.13	0.44
Jmb	S7-2896	12.8	1.24	2.35	0.66	1.42	0.47	0.31
	S7-2941	10.4	3.00	1.91	0.39	1.46	0.50	0.15
	S7-2978	13.8	1.34	2.06	0.88	1.35	0.48	0.20
	S7-3013	12.5	1.07	2.50	1.70	1.67	0.45	0.19
	S7-3038	13.0	0.75	2.92	2.86	1.78	0.86	0.68
	S7-3057	12.0	0.34	8.15	1.99	2.63	2.03	0.96
	S7-3091	12.2	0.65	7.25	2.2	2.43	0.95	0.94
	S7-3133	12.1	0.69	7.94	1.9	2.68	2.13	0.65
	S7-3155	11.4	1.56	8.40	2.3	3.69	0.84	0.35
Jmw	S7-3190	12.9	0.76	2.53	3.33	1.70	0.21	0.34
	S7-3191	11.2	0.74	6.80	1.2	2.39	1.68	0.27
	S7-3195	12.2	0.51	10.4	1.4	3.04	1.80	0.67
	S7-3213	11.0	2.51	5.50	2.1	2.26	2.69	0.64
	S7-3223*	11.0	3.32	11.0	1.5	2.63	0.58	0.40
	S7-3229*	10.9	1.02	11.4	1.1	2.86	3.85	0.41
	S7-3247*	12.9	0.46	11.7	1.17	3.00	0.94	0.51
	S7-3259*	12.2	1.32	5.78	2.2	2.18	1.03	0.51
	S7-3267*	12.5	1.63	5.66	2.6	1.93	0.27	0.60
	S7-3302	13.1	1.04	4.51	2.2	1.93	0.15	0.92
	S7-3320	12.4	1.69	5.47	0.8	2.24	0.47	0.87
	S7-3388	13.2	1.76	4.35	0.8	1.90	0.48	0.46
	S7-3400	10.3	9.11	1.23	0.4	1.19	0.20	0.24
	S7-3920	11.1	6.94	0.99	0.4	1.58	0.22	0.24
	S7-3423	10.9	1.22	4.90	2.55	2.04	0.17	0.22
	S7-3426	11.3	1.42	3.60	2.99	2.31	0.20	0.24
	S7-3438	11.0	1.96	1.34	0.32	2.43	0.48	0.11

Table 3. --Selected Element Concentrations (ppm) for Ore Zone Samples (< 1 μm fraction) from the Mariano Lake - Lake Valley Drilling Project

Sample	U	V	Ba	Cu	Li	Zn
S3-1863	6200	1000	300	350	120	200
S3-1866	10000	2700	400	120	110	230
S3-1867	11000	2400	410	63	120	250
S4-1910	3300	1900	1400	690	70	<700
S4-1928	3500	1600	1300	190	190	500
S4-1939	1700	420	1300	600	130	90
S7-3223	<600	430	250	250	80	600
S7-3229	<700	350	110	500	100	600
S7-3247	<100	510	200	220	120	180
S7-3259	2800	770	220	770	50	700
S7-3267	<400	300	93	220	54	380

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