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ANALYTICAL RESULTS FOR 50 WATER SAMPLES
FROM MILFORD BASIN, UTAH

by

**UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.**

John B. McHugh and William R. Miller

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards.

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INTRODUCTION

Fifty water samples were collected from Milford basin, west-central Utah, during June of 1980, as part of a hydrogeochemical study of the basin. The water samples were analyzed for calcium, magnesium, sodium, potassium, lithium, silica, alkalinity as bicarbonate, sulfate, chloride, fluoride, nitrate, zinc, copper, molybdenum, arsenic, iron, manganese, aluminum, uranium, selenium, and vanadium content. Specific conductance, pH, and temperature were also measured.

Temperature and pH were measured at the sample site. The remaining analyses were completed at the U.S. Geological Survey laboratory in Denver, Colorado. Sample analyses and localities are presented in this report.

The 50 water samples were collected from 27 irrigation wells, 20 windmills, and 3 springs; figure 1 is a sample locality map of the study area.

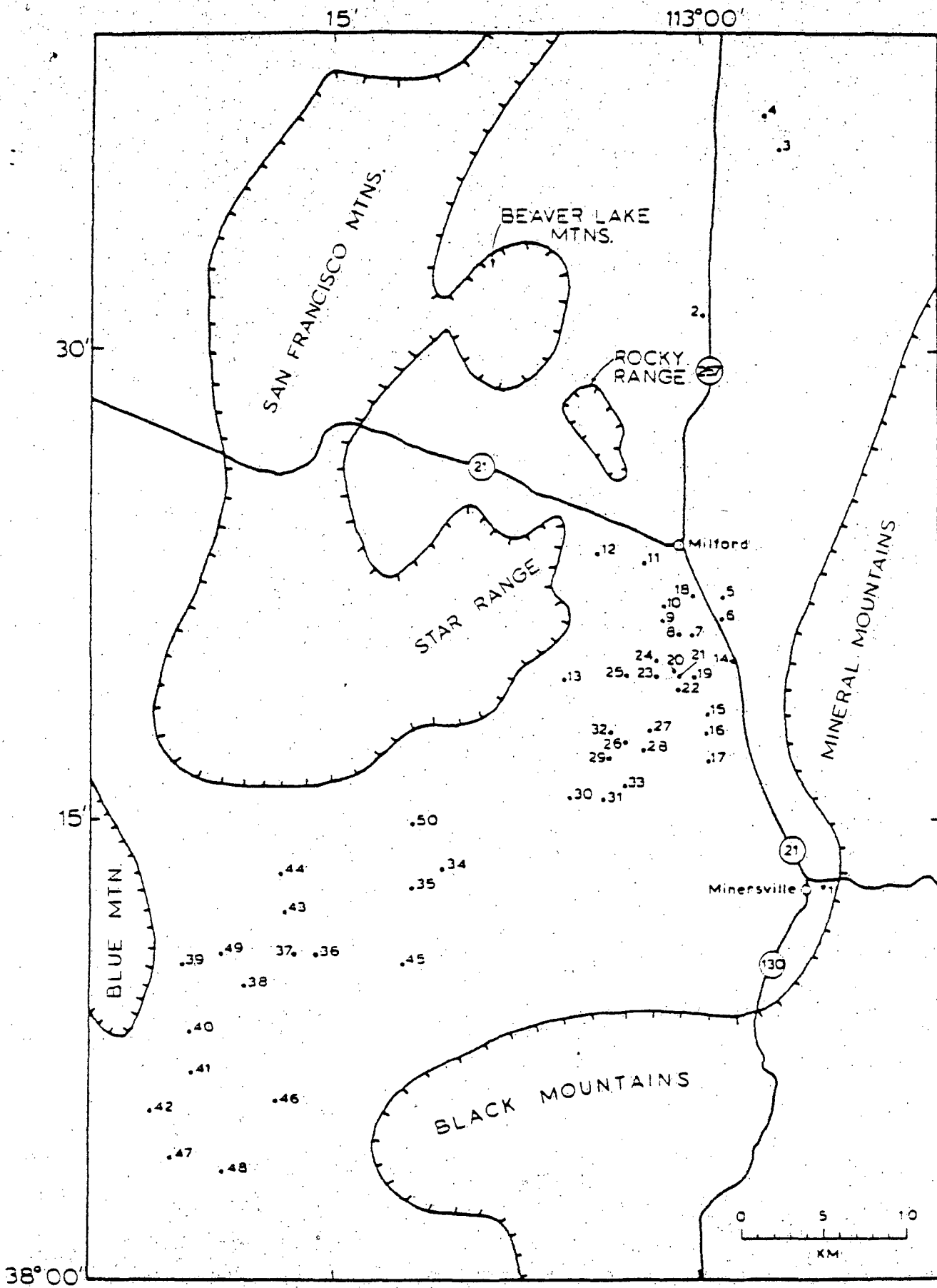


Figure 1.--Sample locality map of Milford basin, Utah.



SAMPLE COLLECTION TECHNIQUES

Water samples were collected in acid-rinsed polyethylene bottles. At each locality, a 60-ml and a 30-ml sample were collected and filtered through a 0.45- μ m and a 0.10- μ m membrane filter, respectively, and acidified with reagent-grade concentrated nitric acid to pH<2. An untreated 0.5 L sample was also taken.

ANALYTICAL TECHNIQUES

Water temperature and pH were measured at each sample site. Calcium, magnesium, sodium, potassium, lithium, silica, zinc, copper, molybdenum, arsenic, selenium, and vanadium were determined using the 0.45- μ m filtered and acidified sample. Iron, manganese, and aluminum were determined using the 0.10- μ m filtered and acidified sample. Alkalinity, sulfate, chloride, fluoride, nitrate, uranium, and specific conductance were determined, using the untreated sample. The analytical methods used for the analysis of each constituent are shown in table 1.

Table 1.--Analytical methods used for water analyses, Milford basin, Utah

Constituent	Method	Reference
Alkalinity-----	Gran's plot potentiometric titration-----	Orion Research, Inc. (1978).
Sulfate-----	Ion chromatography-----	Snee, and Hall (1978)
Chloride-----	do-----	Do.
Fluoride-----	do-----	Do.
Nitrate-----	do-----	Do.
Calcium-----	Flame atomic absorption spectrophotometry-----	Perkin-Elmer Corp. (1976).
Magnesium-----	do-----	Do.
Sodium-----	do-----	Do.
Potassium-----	do-----	Do.
Lithium-----	do-----	Do.
Silica-----	do-----	Do.
Zinc-----	do-----	Do.
Copper-----	Flameless atomic absorption spectrophotometry-----	Perkin-Elmer Corp. (1977).
Molybdenum-----	do-----	Do.
Arsenic-----	do-----	Do.
Iron-----	do-----	Do.
Manganese-----	do-----	Do.
Aluminum-----	do-----	Do.
Selenium-----	do-----	Do.
Vanadium-----	do-----	Do.
Uranium-----	Laser-excited fluorescence-----	Scintrex Corp. (1978).
Specific conductance-----	Conductivity bridge-----	Brown, Skougstad, and Fishman (1970) p. 28-29.

RESULTS

Table 2 is a list of sample locality numbers, sources, and well depth for each sample shown on figure 1. Analytical data for each sample locality, as well as the locality's latitude and longitude in degrees, minutes, and seconds are shown in table 3. Table 4 is a summary of chemical analyses for the 50 Milford basin water samples showing each constituent with its minimum and maximum values, mean, geometric mean, standard deviation, and geometric deviation.

Ionic solutions theoretically are electrically neutral. Therefore, accuracy of analyses can be checked by comparing the sum of the cations to the sum of the anions. For electrical neutral solutions, they are equal to each other. The concentration unit for ionic species is moles/liter. The charge balance of the cations and anions for the 50 samples in this report is within 10 percent of each other.

Table 2.--Source and well depth of 50 water samples, Milford basin, Utah
 [Leaders (--) indicate depth unknown]

Sample number	Source of sample	Approximate depth of well ¹
M01	Spring, Warm Spring	--
M02	Spring	--
M03	Windmill	--
M04	Windmill	--
M05	Irrigation well	440'
M06	Irrigation well	--
M07	Irrigation well	143'
M08	Irrigation well	--
M09	Irrigation well	102'
M10	Irrigation well	210'
M11	Irrigation well	460'
M12	Windmill, Mollies Nipple well	227'
M13	Windmill, Martin well	68'
M14	Irrigation well	--
M15	Irrigation well	422'
M16	Irrigation well	392'
M17	Irrigation well	220'
M18	Irrigation well	220'
M19	Irrigation well	--
M20	Irrigation well	150'
M21	Irrigation well	195'
M22	Irrigation well	200'
M23	Irrigation well	204'
M24	Irrigation well	270'
M25	Irrigation well	150'
M26	Irrigation well	210'
M27	Irrigation well	240'
M28	Irrigation well	445'
M29	Irrigation well	--
M30	Irrigation well	--
M31	Irrigation well	204'
M32	Irrigation well	--
M33	Irrigation well	--
M34	Windmill	--
M35	Windmill	50'
M36	Windmill	74'
M37	Windmill	75'
M38	Windmill	90'
M39	Windmill, Moonshine well	--

Table 2.--Source and well depth of 50 water samples,
Milford basin, Utah--Continued

[Leaders (--) indicate depth unknown]

Sample number	Source of sample	Approximate depth of well ¹
M40	Windmill	--
M41	Windmill	101'
M42	Windmill	--
M43	Windmill	--
M44	Windmill, Lamoreau well	323'
M45	Spring, Thermo Hot Spring	--
M46	Windmill, Blue Knoll well	65'
M47	Windmill	--
M48	Windmill, Lowe well	--
M49	Windmill	149'
M50	Windmill	--

¹From Mower and Cordova (1974).

TABLE 3.-- WATER ANALYSES FROM THE MILFORD BASIN, UTAH

SAMPLE	LATITUDE	LONGITUD	CA(mg/L)	MG(mg/L)	NA(mg/L)	K(mg/L)	LI(ug/L)	SI02(mg/L)	ALK(mg/L)
M01	38 13 2	112 54 14	100	23.0	170	19.0	192	33	214
M02	38 31 7	112 59 43	97	125.0	910	17.0	6,500	24	326
M03	38 36 32	112 56 35	43	14.0	35	8.7	75	71	118
M04	38 37 23	112 57 11	86	25.0	67	5.6	58	57	158
M05	38 22 12	112 58 54	89	37.0	67	3.2	22	25	136
M06	38 21 22	112 58 55	43	13.0	39	7.1	13	27	177
M07	38 20 47	113 0 18	145	37.0	55	6.3	35	40	135
M08	38 20 49	113 0 54	145	37.0	56	6.2	34	40	127
M09	38 21 14	113 1 28	310	75.0	80	10.0	53	44	208
M10	38 21 40	113 1 27	15	8.8	30	2.1	24	25	73
M11	38 23 14	113 2 12	115	41.0	140	19.0	272	53	186
M12	38 23 24	113 4 11	70	47.0	110	4.0	94	42	215
M13	38 19 24	113 5 40	115	64.0	220	3.2	82	22	270
M14	38 20 2	112 58 27	59	29.0	70	3.4	23	28	200
M15	38 18 20	112 59 28	37	19.0	25	2.8	20	22	94
M16	38 17 43	112 59 42	135	28.0	49	6.3	20	32	261
M17	38 16 49	112 59 28	100	20.0	34	5.3	18	30	309
M18	38 22 5	113 0 13	47	21.0	85	2.7	30	29	142
M19	38 19 28	113 0 10	105	28.0	28	5.3	26	36	154
M20	38 19 43	113 1 8	25	8.3	21	2.9	17	32	96
M21	38 19 31	113 0 49	69	14.0	25	4.0	13	36	149
M22	38 19 8	113 0 52	150	31.0	42	6.6	22	37	272
M23	38 19 28	113 1 42	140	30.0	35	6.7	25	41	236
M24	38 20 7	113 1 41	110	27.0	42	6.5	28	44	209
M25	38 19 32	113 2 52	120	27.0	54	6.7	23	43	128
M26	38 17 30	113 2 53	100	19.0	28	5.4	19	37	108
M27	38 17 43	113 1 52	18	7.8	37	3.1	30	29	97
M28	38 17 13	113 2 12	54	13.0	28	4.3	22	33	95
M29	38 16 56	113 3 44	31	9.3	27	4.5	22	42	123
M30	38 15 44	113 5 20	430	76.0	140	16.0	66	48	93
M31	38 15 44	113 3 55	99	18.0	65	6.7	23	40	208
M32	38 17 42	113 3 42	82	15.0	25	5.8	19	42	73
M33	38 16 9	113 3 4	49	11.0	26	4.9	18	38	87
M34	38 13 23	113 10 37	34	17.0	82	5.7	78	51	124
M35	38 12 57	113 11 44	32	17.0	150	4.1	96	42	155
M36	38 10 38	113 15 30	92	48.0	96	7.6	84	46	109
M37	38 10 42	113 16 42	130	76.0	140	7.2	160	51	175
M38	38 9 47	113 18 45	100	70.0	77	8.9	140	52	128
M39	38 10 13	113 21 12	97	35.0	60	4.5	58	19	144
M40	38 8 10	113 20 56	66	30.0	52	5.3	35	34	159
M41	38 6 41	113 20 47	77	31.0	55	5.3	32	41	136
M42	38 5 32	113 22 20	96	33.0	78	5.9	38	35	125
M43	38 11 58	113 17 8	62	33.0	36	3.4	56	39	80
M44	38 13 18	113 17 13	15	5.0	69	1.9	105	63	149
M45	38 10 24	113 12 11	73	9.0	360	53.0	370	111	344

TABLE 3. WATER ANALYSES FROM THE MILFORD BASIN, UTAH--continued

SAMPLE	SO4 (mg/L)	CL (mg/L)	F (mg/L)	NO3 (mg/L)	ZN (ug/L)	CU (ug/L)	MO (ug/L)	AS (ug/L)	FE (ug/L)
M01	460	58	3.00	.10	8	11.0	2.9	23.0	8
M02	14	1,900	.96	2.70	6	26.0	8.0	40.0	310
M03	44	42	3.10	.60	24	1.6	3.8	200.0	280
M04	54	147	1.10	1.80	13	2.6	6.7	110.0	18
M05	240	83	.41	8.90	16	4.7	3.6	3.5	8
M06	36	25	.55	.10	17	2.7	5.1	8.8	4
M07	224	247	.34	8.90	7	5.0	4.4	7.0	22
M08	224	244	.41	7.10	8	4.9	4.3	7.1	10
M09	680	277	.27	13.00	8	7.0	6.0	3.3	7
M10	31	15	1.10	.40	7	.8	4.6	20.0	5
M11	210	250	1.90	70.00	14	3.1	13.0	13.0	8
M12	154	133	.26	41.00	52	7.3	3.8	8.3	30
M13	500	161	1.30	3.70	186	10.1	9.6	3.9	70
M14	144	53	.52	6.50	3	3.8	3.1	7.5	9
M15	67	28	.32	5.60	2	1.6	4.6	12.0	11
M16	115	97	.39	33.00	6	4.5	3.9	4.9	15
M17	67	47	.39	13.00	15	3.8	3.2	6.7	7
M18	135	75	.78	.93	8	3.3	4.0	17.0	8
M19	96	142	.32	19.00	12	4.0	3.4	6.8	12
M20	20	14	.65	.20	5	1.1	3.3	12.0	6
M21	48	56	.52	7.40	4	2.1	3.1	7.3	180
M22	125	139	.71	19.00	14	5.3	4.1	4.9	14
M23	115	175	.78	13.00	5	4.8	3.8	5.1	8
M24	135	125	1.00	15.00	7	3.7	3.8	7.6	12
M25	240	116	.26	7.40	6	3.7	3.9	5.1	9
M26	60	118	.33	33.00	13	3.5	3.3	6.7	8
M27	39	11	.52	.80	2	1.4	3.7	30.0	7
M28	50	45	.33	22.00	2	2.1	3.2	14.0	7
M29	33	26	.40	3.90	5	1.0	3.0	12.0	7
M30	520	605	.13	.10	12	8.7	7.0	3.3	9
M31	80	113	.26	15.00	9	2.7	3.7	8.9	7
M32	60	105	.33	17.00	5	2.7	3.2	6.1	7
M33	40	39	.33	26.00	5	1.9	2.5	9.1	7
M34	120	66	.33	.93	18	4.4	2.2	25.0	14
M35	170	105	.53	1.90	10	6.1	1.2	62.0	14
M36	140	263	.33	5.60	20	2.2	4.4	14.0	17
M37	140	442	.26	7.40	11	2.8	4.3	14.0	32
M38	170	283	.95	7.40	8	3.2	6.1	17.0	25
M39	150	139	.47	13.00	46	2.8	6.7	14.0	31
M40	96	100	.41	6.40	7	1.9	4.4	14.0	27
M41	170	83	.47	.10	12	7.4	9.0	11.0	29
M42	230	133	.47	.70	24	4.2	8.3	6.5	100
M43	87	131	.27	10.00	47	7.5	3.8	14.0	180
M44	77	25	.68	3.60	185	21.0	3.9	20.0	172
M45	404	200	5.40	.10	4	17.0	1.5	140.0	8

TABLE 3. --WATER ANALYSES FROM THE MILFORD BASIN, UTAH-- continued

SAMPLE	MN(ug/L)	AL(ug/L)	U(ug/L)	SE(ug/L)	V(ug/L)	SP. COND. (umhos/cm)	pH	TEMP. (C)
M01	2.2	37	.52	1.6	7	1,460	7.36	35.5
M02	25.0	150	<.10	2.4	20	5,900	9.45	26.5
M03	28.0	80	<.10	9.2	4	520	7.65	21.0
M04	.8	44	3.20	.8	16	950	7.77	11.0
M05	.7	35	3.90	2.2	10	1,040	8.03	20.0
M06	.9	20	9.00	3.5	10	510	8.55	19.0
M07	1.4	19	22.00	2.2	15	1,380	7.50	16.5
M08	1.3	32	21.00	7.7	15	1,360	7.55	18.0
M09	1.0	27	14.00	6.6	24	2,300	7.03	14.5
M10	.7	20	4.30	1.9	9	300	8.15	19.0
M11	30.0	30	1.80	2.3	16	1,710	7.72	18.0
M12	2.8	26	6.00	1.3	13	1,270	7.54	16.5
M13	11.0	53	9.50	4.3	9	2,050	7.44	13.5
M14	1.0	20	6.00	4.8	10	840	7.98	16.5
M15	.6	24	3.90	2.6	10	490	8.13	17.0
M16	.6	22	30.00	3.3	12	1,130	7.65	15.0
M17	.6	18	28.00	3.1	10	820	7.40	14.0
M18	.7	30	7.10	3.5	21	830	8.10	20.5
M19	1.0	25	9.50	3.3	11	1,000	7.85	15.0
M20	2.5	19	3.40	1.1	11	310	7.98	20.0
M21	1.0	21	14.00	2.5	10	600	7.75	15.5
M22	3.0	46	52.00	3.5	13	1,230	7.60	14.5
M23	.8	36	16.00	4.1	12	1,180	7.42	14.0
M24	.6	31	9.00	4.9	13	1,040	7.44	14.0
M25	1.0	33	7.30	4.4	12	1,120	7.92	15.0
M26	1.3	25	8.60	2.8	10	860	7.83	15.0
M27	.8	47	3.20	1.6	14	350	8.13	20.5
M28	.9	26	4.90	2.2	11	550	7.93	18.0
M29	.8	32	3.70	1.2	12	400	8.08	17.0
M30	1.2	66	2.40	6.2	27	3,300	7.66	14.5
M31	.8	20	20.00	3.2	11	940	7.80	14.5
M32	.5	21	5.60	2.8	9	750	8.08	14.0
M33	.5	23	4.70	1.9	10	510	8.00	15.0
M34	.8	17	3.90	2.3	20	770	8.00	15.5
M35	2.5	20	3.90	1.4	26	1,070	8.25	15.0
M36	.9	25	4.30	2.0	14	1,450	7.70	14.0
M37	1.4	27	3.40	2.9	18	2,200	7.70	13.5
M38	.9	26	2.40	1.9	17	1,650	7.70	14.0
M39	1.7	27	2.00	2.0	8	1,110	7.89	15.5
M40	1.1	23	2.80	1.5	7	880	7.80	14.0
M41	.8	22	2.10	1.4	11	940	7.85	14.0
M42	1.7	29	2.20	1.8	12	1,160	7.95	15.5
M43	1.0	15	2.40	1.8	11	840	7.95	16.0
M44	3.0	33	4.30	.5	9	570	8.10	18.0
M45	12.0	35	<.10	1.3	5	2,100	8.00	93.0

TABLE 3. -- WATER ANALYSES FROM THE MILFORD BASIN, UTAH -- continued

SAMPLE	LATITUDE	LONGITUD	CA(mg/L)	HG(mg/L)	NA(mg/L)	K(mg/L)	LI(ug/L)	SI02(mg/L)	ALK(mg/L)
M46	38 5 58	113 17 19	180	170.0	320	9.5	120	49	245
M47	38 3 57	113 21 40	165	140.0	290	10.0	98	42	157
M48	38 3 23	113 19 31	66	64.0	72	6.8	53	47	194
M49	38 10 45	113 19 34	65	27.0	47	4.1	50	27	144
M50	38 14 56	113 11 39	34	14.0	42	3.2	40	58	140

TABLE 3.--WATER ANALYSES FROM THE MILFORD BASIN, UTAH--continued

SAMPLE	SO4 (mg/L)	CL (mg/L)	F (mg/L)	NO3 (mg/L)	ZN (ug/L)	CU (ug/L)	MO (ug/L)	AS (ug/L)	FE (ug/L)
M46	1,060	367	1.00	7.20	24	16.0	4.7	8.6	46
M47	788	433	.82	22.00	96	12.0	5.3	15.0	56
M48	317	61	.74	3.60	42	7.6	2.0	14.0	25
M49	77	100	.95	.10	172	4.1	5.7	15.0	12
M50	38	33	.54	13.00	140	3.3	6.1	21.0	23

TABLE 3.--WATER ANALYSES FROM THE MILFORD BASIN, UTAH--continued

SAMPLE	MN($\mu\text{g/L}$)	AL($\mu\text{g/L}$)	U($\mu\text{g/L}$)	SE($\mu\text{g/L}$)	V($\mu\text{g/L}$)	SP. COND. ($\mu\text{mhos/cm}$)	pH	TEMP. (C)
M46	1.1	17	3.40	4.9	27	3,400	7.53	12.0
M47	85.0	28	3.00	3.1	21	3,200	7.54	13.0
M48	2.1	30	3.90	2.9	14	1,190	7.80	12.0
M49	1.4	21	1.50	2.2	7	790	7.75	15.0
M50	1.2	16	2.60	1.2	12	500	7.90	18.0

Table 4.--Summary of chemical analyses of 50 water samples, Milford basin, Utah

[Leaders (--) indicate no data]

Constituent	Minimum	Maximum	Mean	Geometric mean	Standard deviation	Geometric deviation
Ca (mg/L)	15.	430.	94.3	75.5	71.0	1.99
Mg (mg/L)	5.0	170.	36.3	26.7	33.7	2.17
Na (mg/L)	21.	910.	98.2	64.7	139.	2.24
K (mg/L)	1.9	53.	7.35	5.82	7.67	1.84
Li (µg/L)	13.	6500.	211.	48.8	928.	3.12
SiO ₂ (mg/L)	19.	110.	40.6	38.4	14.9	1.38
Alkalinity (mg/L)	73.	344.	164.	152.	65.9	1.47
SO ₄ (mg/L)	14.	1060.	186.	117.	210.	2.61
Cl (mg/L)	11.	1900.	174.	100.	278.	2.76
F (mg/L)	0.13	5.4	0.772	0.561	0.892	2.04
NO ₃ (mg/L)	0.10	70.	10.4	3.82	12.9	6.26
Zn (µg/L)	2.0	186.	27.4	12.6	46.0	3.12
Cu (µg/L)	0.80	26.	5.52	4.07	5.13	2.15
Mo (µg/L)	1.2	13.	4.58	4.17	2.17	1.56
As (µg/L)	3.3	200.	21.2	12.2	35.6	2.44
Fe (µg/L)	4.0	310.	38.8	17.6	67.6	3.01
Mn (µg/L)	0.50	85.	4.89	1.57	13.3	3.16
Al (µg/L)	15.	150.	31.4	28.0	21.1	1.53
U (µg/L)	0.10	52.	7.66	4.06	9.43	3.87
Se (µg/L)	0.50	9.2	2.88	2.46	1.75	1.77
V (µg/L)	4.0	27.	13.1	12.1	5.39	1.49
Sp. Cond. (µmhos/cm)	300.	5900.	1260.	1020.	990.	1.88
pH	7.03	9.45	7.84	--	0.358	--
Temp. (C°)	11.	93.	17.9	16.6	11.5	1.38

REFERENCES CITED

- Brown, Eugene, Skougstad, M. W., and Fishman, J. J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water Resources Investigations TWI 5-AI, 160 p.
- Mower, R. W., and Cordova, R. M., 1974, Water resources of the Milford area, Utah, with emphasis on ground water: State of Utah Department of Natural Resources Technical Publication, no. 43, 106 p.
- Orion Research, Inc., 1978, Analytical Methods Guide, 9th ed.: Cambridge, Massachusetts, 48 p.
- Perkin-Elmer Corporation, 1976, Analytical methods for atomic absorption spectrophotometry: Norwalk, Connecticut, Perkin-Elmer Corp., 586 p.
- _____ 1977, Analytical methods for atomic absorption spectrophotometry, using the HGA graphite furnace: Norwalk, Connecticut, Perkin-Elmer Corp., 208 p.
- Scintrex Corporation, 1978, UA-3 uranium analyzer: Toronto, Canada, 45 p.
- Smee, B. W., and Hall, G. E. M., 1978, Analysis of fluoride, chloride, nitrate, and sulphate in natural waters, using ion chromatography: Journal of Geochemical Exploration, v. 10, no. 3, p. 245-258.