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Chemical analyses of 33 surface water samples from the Gunnison area, Colorado

by

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INTRODUCTION

The study area for this report lies approximately 15 miles south of Gunnison, Colorado. The purpose of the study was to determine the geochemical range for selected cations and anions of stream, spring, and pond waters from an area underlain by mineralized rocks in this semi-arid cool climate. Vegetation is predominantly sagebrush (*Artemisia*). The average annual precipitation for this area is 12 inches/year (Colorado Climate Center, 1984). Samples were collected from areas where mining has taken place and from mineralized areas where no mining or development has taken place. Many of the streams and springs are ephemeral, so the field work was carried out in late spring to insure flowing water.

The study area is underlain by east-west tending Proterozoic Dubois Greenstone as defined by Hunter (1925). The Dubois Greenstone can be divided into four major rock types: 1) metamorphosed arkose, greywacke, and siltite; 2) metamorphosed basalt to andesite water-lain flows and tuffs; 3) metamorphosed dacite to rhyolite tuffs, pyroturbidites and flows; and 4) syntectonic to late-tectonic granite, granodiorite, and diorite (Drobeck, 1981). Deposits of syngenetic massive sulfide minerals occurs within the rocks. Pyrite and sphalerite are the most common sulfides. Gangue minerals are commonly quartz, chlorite, calcite, and dolomite.

SAMPLE COLLECTION

Thirty-three water samples were collected from streams, springs, and ponds in the Gunnison area, Colorado, during June 7-10, 1994. Samples were collected in polyethylene bottles that had been rinsed with 10 percent nitric acid. At each site, a 60-mL sample was collected and filtered through a 0.45-um filter, and acidified to pH<2 with concentrated nitric acid. An additional unfiltered and unacidified 500-mL sample was also collected.

ANALYTICAL METHODS

At each site temperature and pH were measured. Calcium, magnesium, sodium, potassium, silica, aluminum, manganese, and iron were determined in the filtered acidified samples by flame atomic absorption spectrophotometry (Perkin-Elmer, 1976). Arsenic, copper, molybdenum, uranium, and zinc were determined in the filtered-acidified samples by inductively coupled plasma-mass spectrometry. Fluoride, chloride, sulfate, and nitrate were determined by ion chromatography using the untreated samples (Fishman and Pyen, 1979). Alkalinity was determined in the untreated samples by Gran's plot potentiometric titration (Orion Research, 1978). Specific conductance was also measured. The analytical data for these analyses are shown in table 1.

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Table 1. Chemical analyses of stream, spring, and pond waters from the Gunnison area, Colorado
[Conductivity in µS/cm; species in mg/L except for Cu, Zn, As, Mo, and U in µg/L]

Sample	LATITUDE	LONGITUDE	Ca	Mg	Na	K	SiO_2	Alk.	F	Cl	NO_3
GN01	38 20 25	107 0 27	26	7.4	3.9	6.8	<1	129	.2	1.1	<.1
GN02	38 20 42	106 58 46	43	9.3	6.1	1.9	18	176	<.2	1.8	<.1
GN03	38 21 7	106 58 15	40	8.6	6.8	2.1	24	170	.4	1.4	<.1
GN04	38 21 5	106 57 2	28	6.4	6.9	1.4	36	128	.2	1.6	.1
GN05	38 20 37	106 59 34	56	11	8.7	1.8	18	236	.3	2.7	<.1
GN06	38 20 14	107 0 31	50	10	7.5	1.3	18	216	.3	2.7	<.1
GN07	38 20 59	107 0 21	55	12	8.3	2.5	18	150	.2	2.3	<.1
GN08	38 23 7	107 2 49	51	11	9	2.9	22	225	.3	1.9	<.1
GN09	38 23 4	107 2 49	76	18	15	3.7	22	239	.4	5.9	<.1
GN10	38 20 29	107 0 33	96	22	14	1.3	22	241	.4	4.3	<.1
GN11	38 20 37	107 1 29	39	9.4	9.1	1.8	19	170	.3	3.1	<.1
GN12	38 23 32	107 3 35	14	4.2	10	.8	6	78	.3	.5	.7
GN13	38 19 59	107 6 13	39	10	8	2.1	4	180	.5	5.3	.9
GN14	38 19 34	107 6 4	48	12	9.3	4.6	27	183	.5	3.7	.6
GN15	38 20 43	107 6 48	49	12	18	6.8	8	260	.6	4.1	12
GN16	38 21 13	107 6 44	76	16	14	1.9	25	314	.5	9	<.1
GN17	38 21 19	107 6 44	75	16	13	1.8	22	305	.4	7	<.1
GN18	38 21 8	107 5 48	73	12	8.1	1	21	257	.3	11	<.1
GN19	38 24 59	106 49 48	28	5.5	7.8	.8	22	109	.3	2.5	<.1
GN20	38 24 58	106 49 20	48	9.3	11	.8	24	125	.3	4.1	<.1
GN21	38 24 46	106 49 7	39	8.4	15	1.3	21	188	.3	4.8	<.1
GN22	38 26 8	106 49 33	28	8	10	2.1	21	134	.3	2.7	<.1
GN23	38 26 27	106 48 34	39	8.5	12	2.4	25	184	.4	4.4	<.1
GN24	38 25 29	106 50 46	16	4.5	7.2	.4	11	73	.3	1.4	<.1
GN25	38 25 29	106 50 46	30	4.7	7.2	.4	18	123	.3	1.7	<.1
GN26	38 27 32	106 50 40	34	8.1	8.5	.6	18	133	.4	4.4	1.3
GN27	38 28 4	106 50 49	50	11	11	1.7	23	183	.5	4.3	<.1
GN28	38 24 3	106 44 32	29	33	18	1.2	6	186	1.3	4.4	<.1
GN29	38 24 47	106 44 1	21	5	8.5	1.7	43	85	.4	2.6	1.5
GN30	38 25 45	106 43 50	32	8.9	10	1.6	41	129	.6	2.6	<.1
GN31	38 22 47	106 48 0	45	13	6.6	3	33	186	.3	2	<.1
GN32	38 22 3	106 46 32	32	22	13	4.9	26	199	.8	5.6	<.1
GN33	38 21 17	106 46 54	39	10	16	3.5	40	185	.6	2.1	<.1

Table 1. Chemical analyses of stream, spring, and pond waters from the Gunnison area, Colorado
[Conductivity in µS/cm; species in mg/L except for Cu, Zn, As, Mo, and U in µg/L]--Continured

Sample	SO_4	Fe	Mn	Al	As	Cu	Mo	U	Zn	pH	Cond.	Temp. °C
GN01	<.1	.5	.12	<.1	2	1	<1	<.1	3	6.06	215	18
GN02	1.6	.04	.06	<.1	<2	1	<1	.5	2	7.03	303	20
GN03	3.2	.05	.02	<.1	5	<1	1	1.8	<1	8.04	293	12
GN04	1.9	.04	.01	<.1	2	<1	<1	.7	1	6.97	221	7
GN05	4.8	.05	.02	<.1	<2	1	2	4.2	2	7.78	386	15
GN06	6.1	.04	.04	<.1	<2	1	1	1	1	7.27	354	9
GN07	59	.08	.04	<.1	<2	13	1	1.2	43	7.34	410	19
GN08	2.7	.07	.06	<.1	3	1	2	2.6	<1	8.08	359	19
GN09	72	.03	.01	<.1	<2	2	2	4.5	<1	7.53	557	19
GN10	141	.11	.04	<.1	<2	9	1	1.6	40	7.43	677	13
GN11	5.1	.07	.02	<.1	<2	<1	1	1.4	<1	7.64	301	17
GN12	2	.27	.04	<.1	3	<1	1	.8	<1	9.95	134	20
GN13	4.1	.18	.04	<.1	6	1	2	.9	2	7.43	309	21
GN14	6.4	1.9	1.3	<.1	41	1	6	3	2	7.12	323	21
GN15	7.3	.22	.05	<.1	4	2	2	4.6	1	7.4	436	24
GN16	21	.07	.09	<.1	<2	<1	2	2.8	1	7.12	563	15
GN17	18	.02	<.01	<.1	<2	1	2	3	1	7.41	535	7
GN18	9.6	.11	.08	<.1	5	1	1	1	<1	7.19	481	18
GN19	8.1	.05	.01	<.1	<2	<1	1	.8	1	7.16	218	7
GN20	69	.04	<.01	<.1	<2	2	1	.6	12	7.25	378	9
GN21	17	.1	.07	<.1	2	1	1	1.5	<1	7.56	332	18
GN22	5.9	.09	.01	<.1	<2	1	2	1.5	1	8.02	243	18
GN23	6.5	.06	.02	<.1	2	<1	3	1.7	<1	8.16	318	17
GN24	5.1	.1	.03	<.1	3	<1	2	.6	<1	9.06	143	24
GN25	6.3	.06	.04	<.1	<2	1	2	.9	2	7.54	220	16
GN26	16	.07	.04	<.1	<2	<1	2	.6	1	7.15	273	11
GN27	27	.07	.04	<.1	<2	1	3	.9	<1	7.4	375	11
GN28	70	.07	.07	<.1	4	1	3	9	1	8.99	452	15
GN29	7.6	.04	<.01	<.1	11	<1	1	1	1	7.37	184	7
GN30	13	.02	<.01	<.1	8	<1	2	1	<1	7.73	271	9
GN31	13	.04	.03	<.1	2	1	1	2.6	<1	7.88	344	11
GN32	13	.04	.02	<.1	3	1	3	1.7	<1	8.39	374	20
GN33	16	.14	.03	<.1	10	<1	6	1.8	<1	8.77	332	18