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

by

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INTRODUCTION

The Redcloud Peak areas, west and southwest of Lake City, Colorado, was selected for study because no significant mining or acid mine drainage is associated with the study area. The study area was determined to have high potential for base and precious metals in vein and breccia-pipe epithermal deposits and moderate potential for molybdenum and copper porphyry deposits (Sanford and others, 1987). The study area lies mostly within the Lake City caldera and exposed rocks are mainly a caldera-fill sequence of high silica to quartz trachytic ash-flow tuffs and caldera collapse breccia.

SAMPLE COLLECTION

Thirty-three samples of water were collected from streams in the Redcloud Peak area on July 21-23, 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. Ferrous iron was also determined at each site colorimetrically with a Hach DR/2000 spectrophotometer. 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, cobalt, nickel, 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), as was specific conductance. The analytical data for these analyses are shown in table 1.

REFERENCES CITED

Fishman, M.J., and Pyen, Grace, 1979, Determination of selected anions in water by ion chromatography: U.S. Geological Survey Water Resources Investigations 79-101, 30 p.

Orion Research Inc., 1978, Orion Research analytical guide (9th ed.): Cambridge, Mass., 48 p.

Sanford, R.F., Grauch, R.I., Hon, K., Bove, D.J., and Grauch, V.J.S., 1987, Mineral resources of the Redcloud Peak and Handies Peak wilderness study area, Hinsdale County, Colorado: U.S. Geological Survey Bulletin 1715, 38 p.

Perkin-Elmer Corporation, 1976, Analytical methods for atomic absorption spectrophotometry: Norwalk, Conn., Perkin-Elmer Corp., 586 p.

Table 1. Analytical data for 33 water samples from Redcloud Peak area, Colorado

Sample	LATITUDE	LONGITUDE	Ca(mg/L)	Mg(mg/L)	Na(mg/L)	K(mg/L)	ALK(mg/L)	F(mg/L)
RW01	38 1 6	107 21 30	15	2.4	2.1	.9	13	0.23
RW02	37 58 59	107 29 7	15	1.7	0.7	0.5	29	0.12
RW03	38 0 27	107 26 51	31	3.3	1.5	0.8	<1	0.41
RW04	38 0 30	107 26 6	17	1.3	1	0.4	10	0.2
RW05	38 1 13	107 24 6	19	1.5	1	0.5	20	0.18
RW06	38 1 5	107 22 24	14	1.9	1.7	0.4	23	0.16
RW07	37 56 33	107 29 57	25	5.3	0.4	0.5	18	0.15
RW08	37 56 31	107 29 57	18	1.8	0.4	0.4	26	0.11
RW09	37 56 44	107 29 31	13	1	0.5	0.4	21	0.11
RW10	37 56 40	107 28 42	14	2.5	0.4	0.9	12	0.09
RW11	37 56 37	107 28 9	12	1.5	1	1.2	15	0.27
RW12	37 56 54	107 26 19	12	2	0.6	1.9	<1	0.19
RW13	37 56 56	107 26 18	17	2.9	1.6	1.1	17	0.2
RW14	37 56 56	107 26 25	22	4.5	2.2	4.5	<1	0.96
RW15	37 56 46	107 26 39	7.8	1.2	0.6	1.7	13	0.15
RW16	37 56 28	107 27 13	11	2	0.5	3.6	<1	0.33
RW17	38 0 12	107 21 45	15	2.4	2	0.9	18	0.18
RW18	38 0 17	107 21 46	28	4.3	4.4	0.5	86	0.1
RW19	38 0 35	107 21 40	85	10	26	1.1	179	0.39
RW20	37 55 25	107 20 1	13	1.2	4	0.4	40	0.1
RW21	37 54 29	107 22 31	12	1.4	1.2	0.7	29	0.07
RW22	37 54 26	107 22 49	12	1.4	1.2	0.7	15	0.08
RW23	37 54 24	107 25 55	18	1.6	2.3	0.3	45	0.32
RW24	37 54 44	107 26 27	33	2	4.4	1.2	94	0.28
RW25	37 55 5	107 26 51	11	1.2	1.1	1	13	0.09
RW26	37 56 9	107 27 30	14	2.4	1.1	1.7	<1	0.2
RW27	37 54 20	107 24 33	6.3	0.5	0.9	0.5	23	0.08
RW28	37 54 24	107 21 47	16	1.8	1.7	0.8	28	0.16
RW29	38 1 9	107 21 33	18	2.1	2.3	0.6	35	0.14
RW30	37 58 22	107 26 33	12	1.4	1.2	1.2	<1	0.26
RW31	37 58 24	107 26 36	7.6	0.7	0.4	0.4	15	0.12
RW32	37 57 53	107 27 4	14	2.3	1.1	2.3	<1	0.69
RW33	37 57 19	107 27 50	6.7	0.7	0.4	0.5	20	<.05

Table 1. Analytical data for 33 water samples from Redcloud Peak area, Colorado--Continued

Sample	Cl(mg/L)	SO_4(mg/L)	NO_3(mg/L)	SiO_2(mg/L)	Al(mg/L)	Mn(mg/L)	Fe(mg/L)	Fe^{2+}(mg/L)	As(µg/L)
RW01	0.17	42	<.2	9	<0.1	0.02	0.03	0.01	<1
RW02	0.15	32	<0.2	3	<0.1	<0.01	0.02	<0.01	<1
RW03	0.11	93	<0.2	9	0.4	0.18	0.02	<0.01	<1
RW04	0.14	28	<0.2	6	<0.1	<0.01	0.01	0.01	<1
RW05	0.11	34	<0.2	6	<0.1	<0.01	<0.01	<0.01	<1
RW06	0.12	20	<0.2	8	<0.1	<0.01	0.01	<0.01	<1
RW07	<0.1	70	<0.2	3	<0.1	<0.01	0.02	0.02	<1
RW08	<0.1	28	<0.2	3	<0.1	<0.01	0.02	<0.01	<1
RW09	<0.1	22	<0.2	4	<0.1	<0.01	0.01	0.01	<1
RW10	<0.1	42	<0.2	6	<0.1	<0.01	0.01	<0.01	<1
RW11	<0.1	45	0.32	10	1.2	0.5	0.04	0.04	<1
RW12	0.15	49	1.1	9	1.6	0.52	<0.01	<0.01	<1
RW13	0.11	49	0.32	9	0.1	0.15	0.01	0.01	<1
RW14	0.14	106	<0.2	29	2.6	2	0.45	0.21	<1
RW15	0.14	23	<0.2	16	<0.1	<0.01	0.02	<0.01	<1
RW16	0.15	53	<0.2	25	1.7	1.2	0.07	0.07	<1
RW17	0.1	43	<0.2	10	<0.1	0.02	0.27	0.27	<1
RW18	0.29	37	<0.2	12	<0.1	<0.01	<0.01	<0.01	<1
RW19	0.82	176	<0.2	14	<0.1	<0.01	0.01	<0.01	11
RW20	0.17	9	<0.2	9	<0.1	<0.01	<0.01	<0.01	<1
RW21	0.13	23	<0.2	6	<0.1	<0.01	0.01	<0.01	<1
RW22	0.11	23	<0.2	6	<0.1	<0.01	0.03	0.02	<1
RW23	0.15	16	<0.2	7	<0.1	<0.01	0.02	<0.01	<1
RW24	0.17	24	<0.2	8	<0.1	<0.01	0.02	<0.01	<1
RW25	0.11	24	<0.2	8	<0.1	<0.01	0.01	0.01	<1
RW26	0.13	50	0.59	10	0.3	0.26	0.03	0.01	<1
RW27	0.13	6.9	<0.2	6	<0.1	<0.01	0.04	<0.01	<1
RW28	0.19	23	<0.2	7	<0.1	0.01	0.03	0.01	<1
RW29	0.22	31	<0.2	10	<0.1	0.02	0.02	0.01	<1
RW30	<0.1	52	0.37	10	2.1	0.67	0.07	0.05	<1
RW31	0.18	13	<0.2	3	<0.1	<0.01	0.01	<0.01	<1
RW32	0.17	74	<0.2	17	4.4	0.53	0.04	0.04	1
RW33	<0.1	10	<0.2	4	<0.1	<0.01	0.02	0.01	<1

Table 1. Analytical data for 33 water samples from Redcloud Peak area, Colorado--Continued

Sample	Cu(µg/L)	Co(µg/L)	Ni(µg/L)	Mo(µg/L)	U(µg/L)	Zn(µg/L)	SP COND	pH	TEMP C°
RW01	<1	1	1	1	<0.1	<5	128	6.86	15
RW02	<1	<1	<1	1	0.1	<5	110	7.09	8
RW03	1	1	5	<1	0.3	60	230	5.92	12
RW04	<1	<1	<1	7	1.1	<5	119	7.55	9
RW05	<1	<1	<1	3	0.5	<5	132	7.14	7
RW06	<1	<1	<1	1	0.1	<5	105	7.65	7
RW07	<1	<1	1	<1	<0.1	67	195	7.1	11
RW08	<1	<1	<1	1	0.1	22	120	7.37	9
RW09	3	<1	<1	1	0.4	6	87	6.87	11
RW10	<1	<1	<1	<1	<0.1	7	117	6.73	9
RW11	1	1	2	<1	2.6	90	117	5.17	10
RW12	4	<1	2	<1	6.6	110	127	4.92	8
RW13	<1	1	1	2	0.6	10	143	7.18	11
RW14	3	12	7	<1	3.4	280	320	3.58	13
RW15	<1	<1	<1	<1	0.2	10	70	6.08	5
RW16	3	4	3	<1	3.5	83	148	4.17	9
RW17	<1	2	1	1	<0.1	5	128	7	10
RW18	<1	<1	<1	2	1	<5	208	7.92	8
RW19	<1	<1	1	29	2.2	<5	622	7.81	10
RW20	<1	<1	<1	1	0.2	5	95	6.8	9
RW21	<1	<1	<1	<1	0.3	<5	93	6.91	12
RW22	<1	<1	<1	<1	0.2	<5	94	7	12
RW23	<1	<1	<1	6	2.1	<5	121	7.42	11
RW24	<1	<1	<1	9	8.1	<5	210	7.6	11
RW25	<1	<1	<1	1	0.1	<5	87	7.57	8
RW26	3	1	2	<1	2.6	100	129	6.06	14
RW27	<1	<1	<1	2	0.6	<5	44	7.05	11
RW28	<1	<1	<1	1	0.5	<5	115	7.12	16
RW29	2	<1	<1	1	0.3	26	136	7.53	14
RW30	2	3	2	<1	5.2	130	140	4.42	10
RW31	<1	<1	<1	<1	<0.1	<5	55	6.4	8
RW32	6	3	4	<1	4.6	93	194	3.9	6
RW33	<1	<1	<1	<1	<0.1	<5	47	6.6	10