See Mt. Princeton Geology

T 1692

THE GEOLOGY OF THE BUENA VISTA AREA,

CHAFFEE COUNTY, COLORADO

By

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ABSTRACT

The Buena Vista area is located in the upper Arkansas Valley in central Colorado. The thesis area straddles the Rio Grande rift zone and includes the edges of the Sawatch and Mosquito Ranges. Rock units present in the thesis area are Precambrian metamorphic and igneous rocks, Tertiary plutonic and volcanic rocks and Tertiary and Quaternary sedimentary deposits. Economically important features of the area are two groups of hot springs. One of these, Hortense Hot Spring, located at the southeast flank of Mount Princeton, is the hottest spring in Colorado with a temperature of 85° C.

Seven Precambrian rock units are present in the thesis area and they represent an early period of sedimentation and volcanism followed by metamorphism and intrusion of a large quartz monzonite batholith of Boulder Creek age. Paleozoic and Mesozoic sedimentary rocks were apparently deposited on top of the Precambrian rocks. The Sawatch anticlinal uplift formed during the Laramide orogeny. In the Paleocene and Eocene erosion stripped Paleozoic and Mesozoic sedimentary rocks from the uplift and, by the late Eocene, produced a relatively flat erosion surface that sloped east and

southeast. Tertiary intrusive igneous activity began in the Oligocene and continued sporadically until the Miocene. Volcanic flows and ash-flow tuffs were erupted outside the thesis area and flowed across the area during the Oligocene. In the Miocene, regional uplift of over 3,000 m and development of the upper Arkansas graben began. The graben, which has over 3,000 m of displacement, continued to develop through the Miocene and Pliocene with the deposition of the Browns Canyon and Dry Union Formations as basin-fill sediments. In the Pleistocene, pediment gravels and glacial moraine and outwash units were deposited. Faulting along the rift has occurred within the last 30,000 years.

Hydrothermal and hot spring activity that produced an extensive zeolitic alteration pattern probably began in the Miocene (?) and has continued to the present. Geochemistry of the water suggests that the springs are meteoric in origin and have a subsurface temperature in excess of 130° C. Geological evidence supports the hypothesis that the heat source for the springs is the abnormally high geothermal gradient associated with the Rio Grande rift zone. Deep circulation of water along the graben faults produces the thermal springs.

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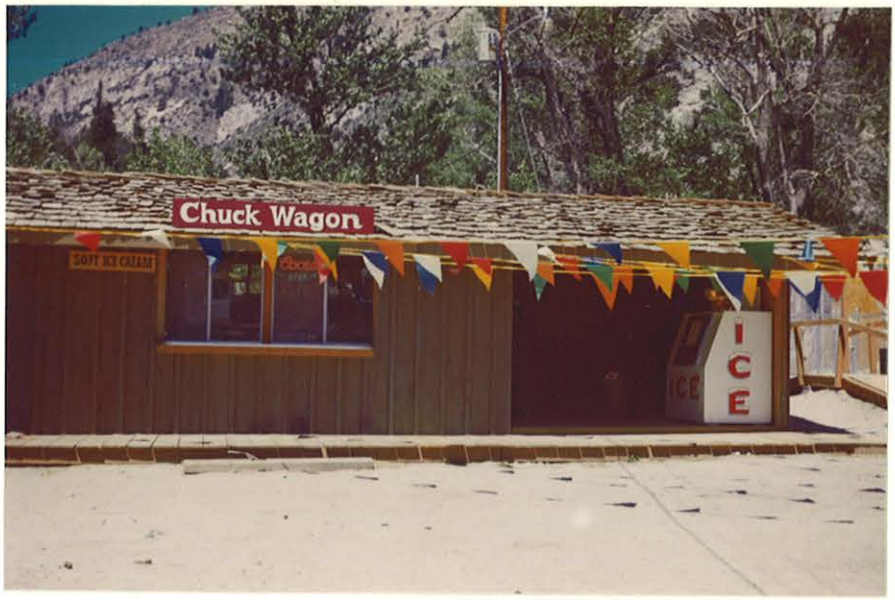


Cottonwood Hot Springs; Jump Steady.

16. Hortense Hot Springs (Part of the Mount Princeton Hot Springs group of other investigators), Chaffee County. This spring, which is the hottest in the State of Colorado, is located approximately one mile west of the Mount Princeton Hot Springs. Its geologic conditions are similar to the Mount Princeton Hot Springs. The discharge of the spring is estimated to be between 22-33 gpm and its temperature ranges from $74^{o}C$-$84^{o}C$. The water is used for swimming pools and space heating at two youth camps.

Pearl 1972.

Silvercliff
Ranch.
Swimming Pool.
Supplied by
Hortense Spring

Old Mount Princeton Hot Springs

Mount Princeton Hot Springs Swimming Pool.

15. Mount Princeton Hot Springs (Chalk Creek Hot Springs), Chaffee County. Mount Princeton Hot Springs are located along State Highway 162 on the north bank of Chalk Creek, 25 miles northwest of Salida, Colorado. The geologic conditions at these springs is quite similar to the Cottonwood Hot Springs area with the heating of the water probably coming from the Tertiary monzonite intrusion which forms the collegiate Range. These hot springs have a total discharge between 250-400 gpm and a temperature range of $48^{\circ}C$-$57^{\circ}C$. The thermal water has limited local use.

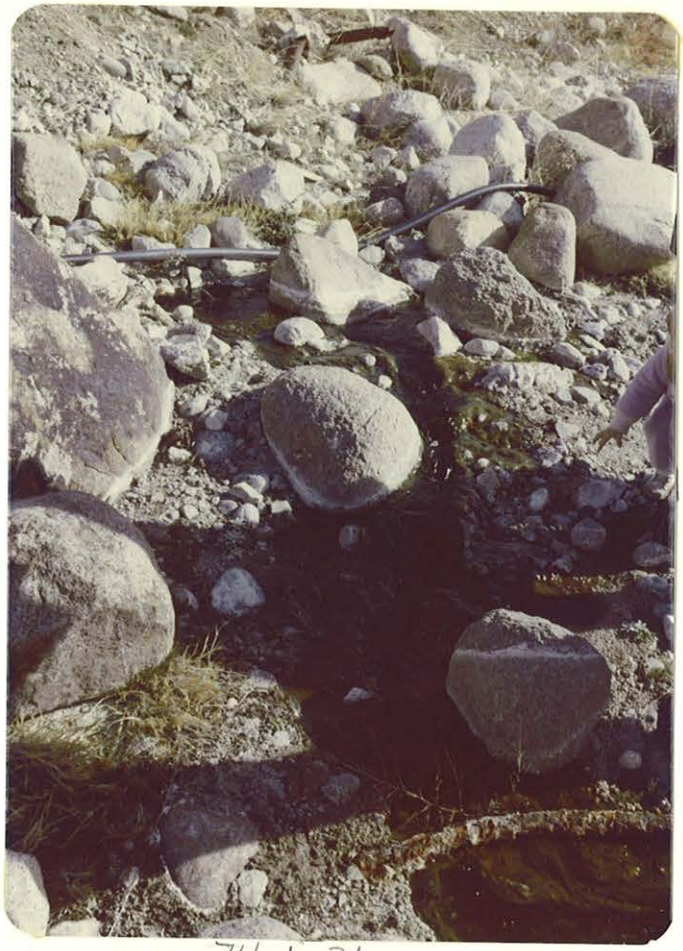
Salida
Swimming
Pool.

Wellsville
Warm Spring

Mt. Princeton Hot Spring

74-1-33

Mt. Princeton Hot Spring



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Cottonwood Hot Spring

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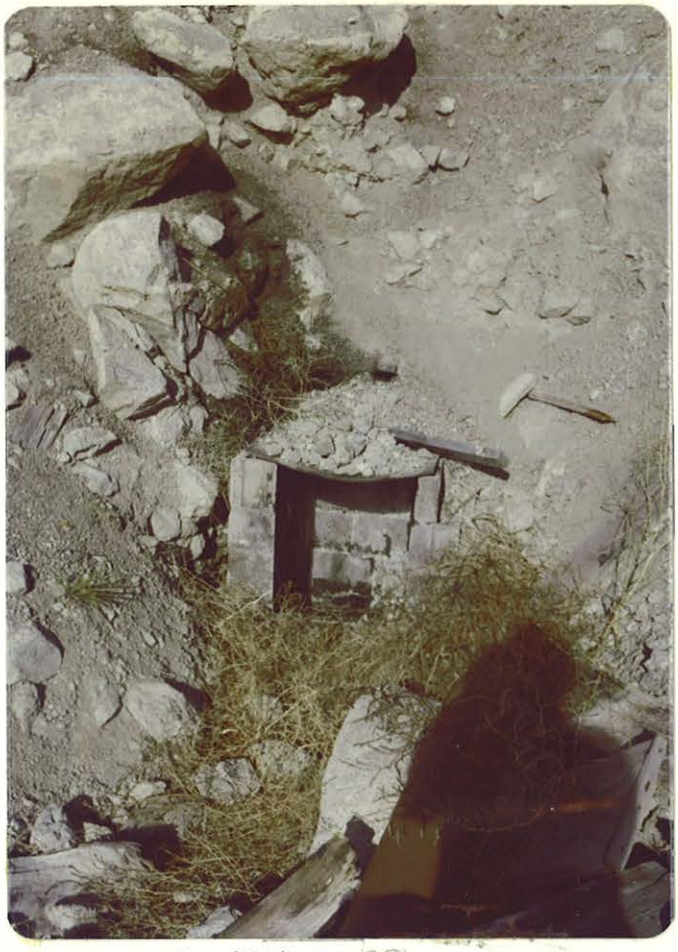
Hortense Hot Spring



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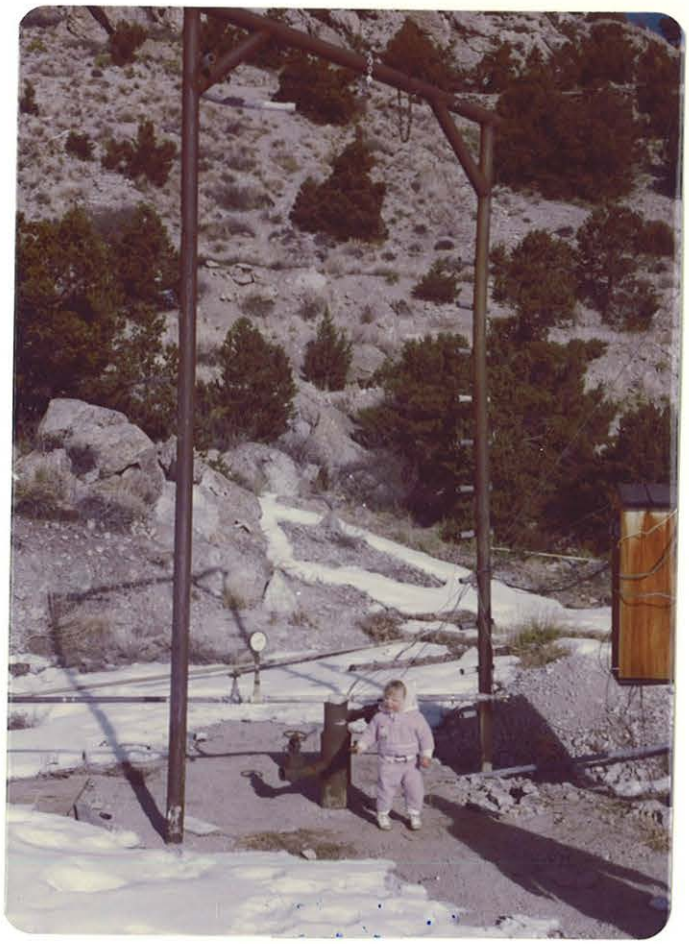
Hortense Hot Spring



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Hortense Hot Springs

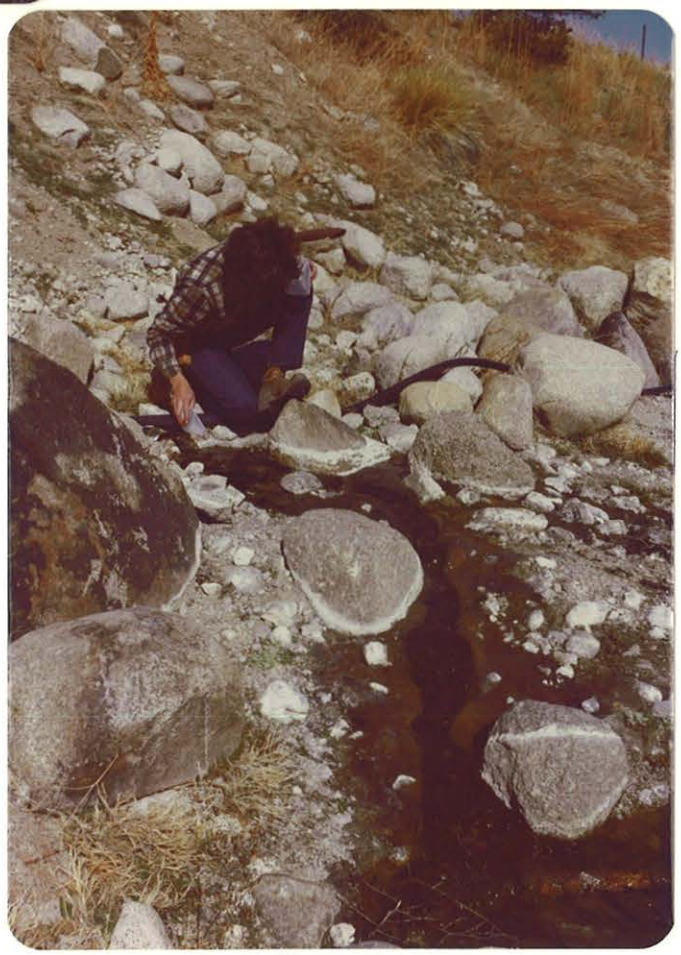
74-3-3

74-3-2

74-3-1

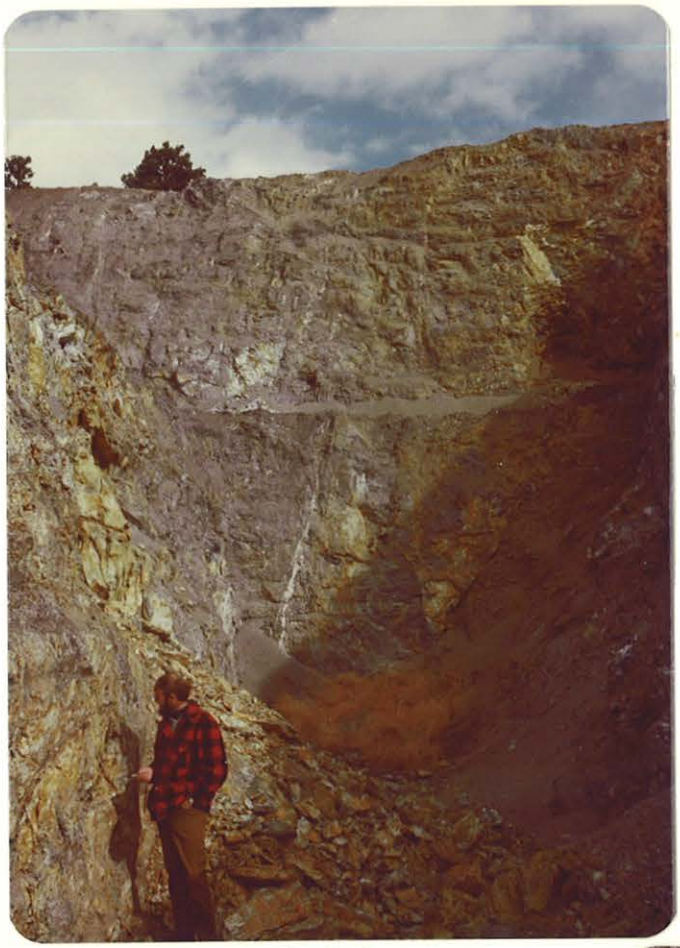
Mt. Princeton Hot Spring

74-3-17



74-3-16

Fluorite Mine



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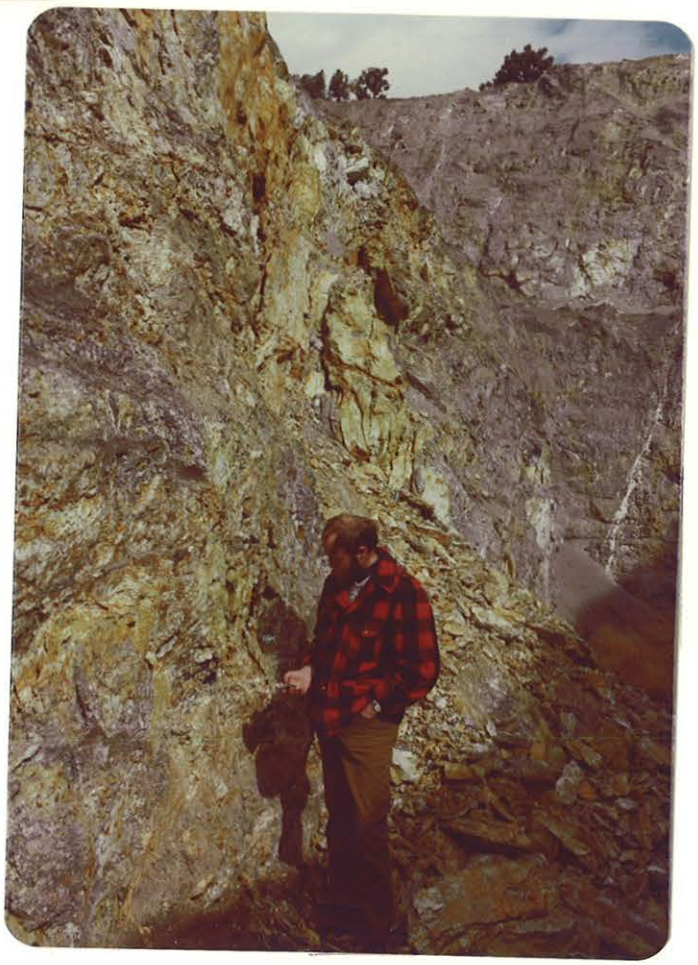

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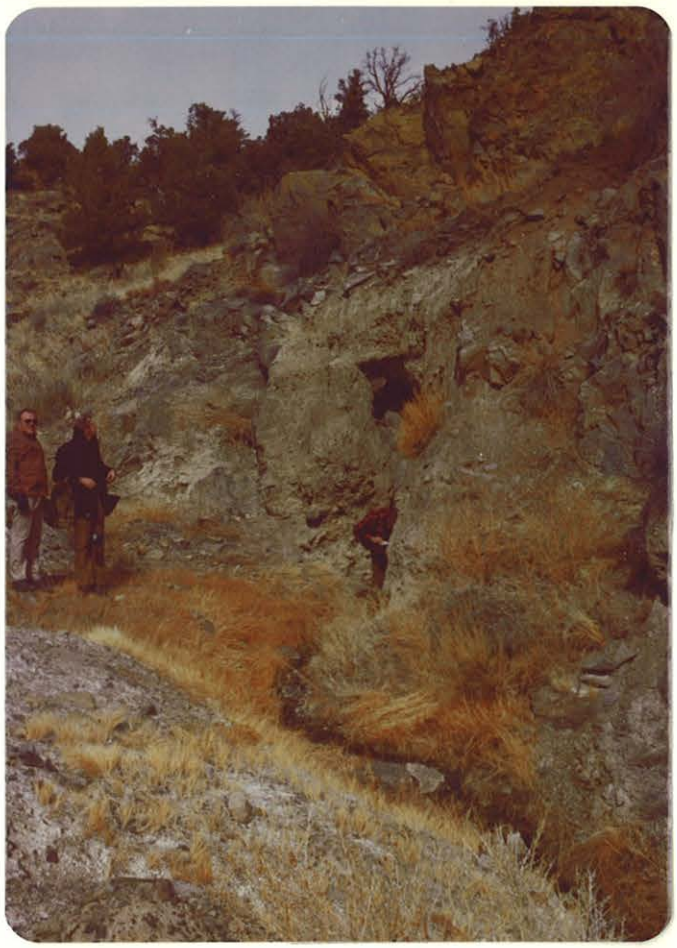
Fluorite Warm Spg



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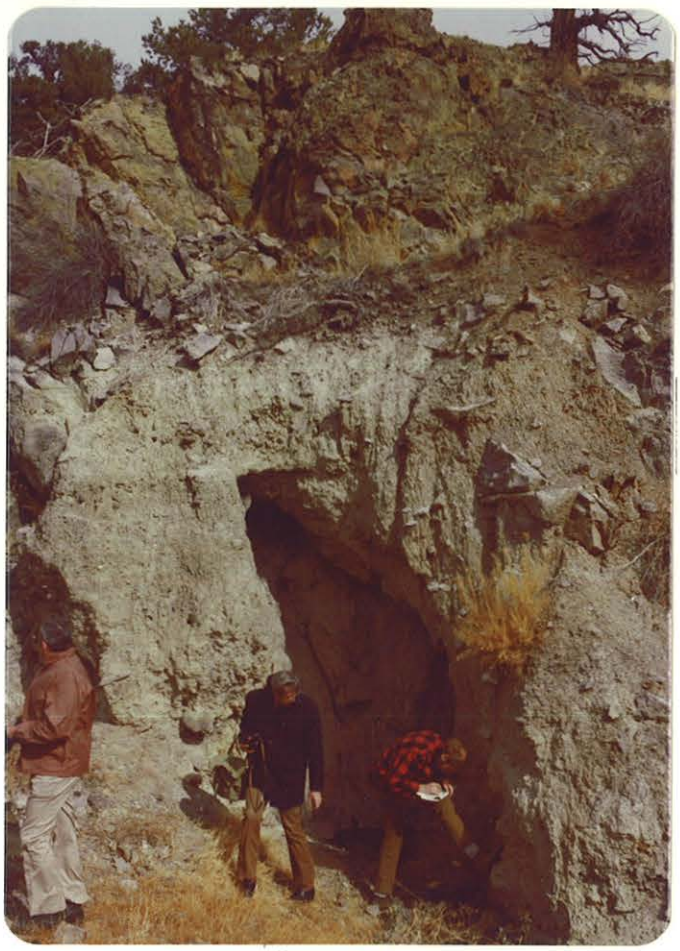

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Bat Tunnel

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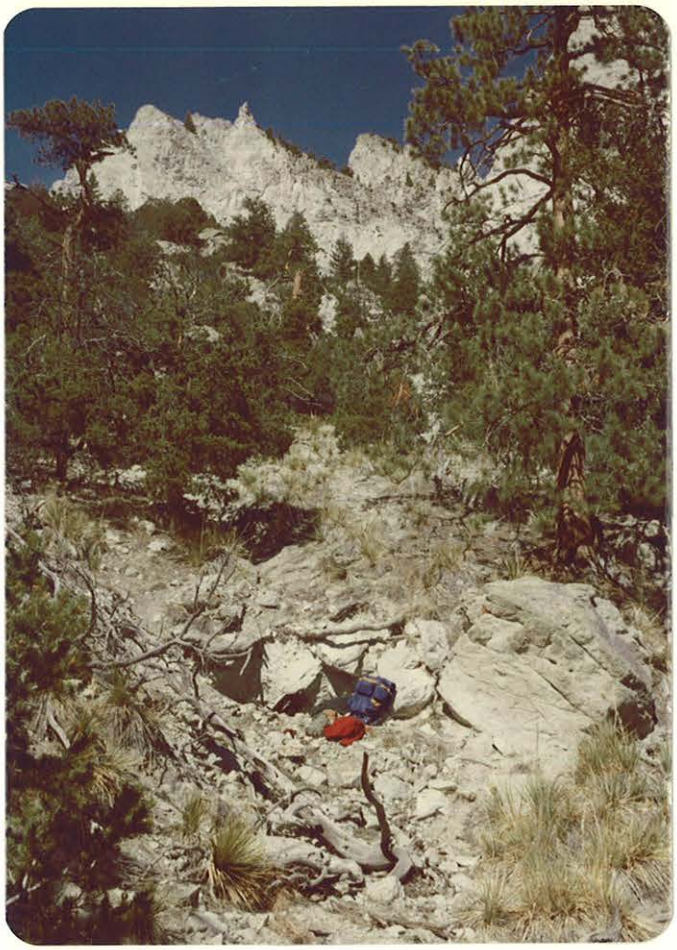
Lower Hot Tunnel



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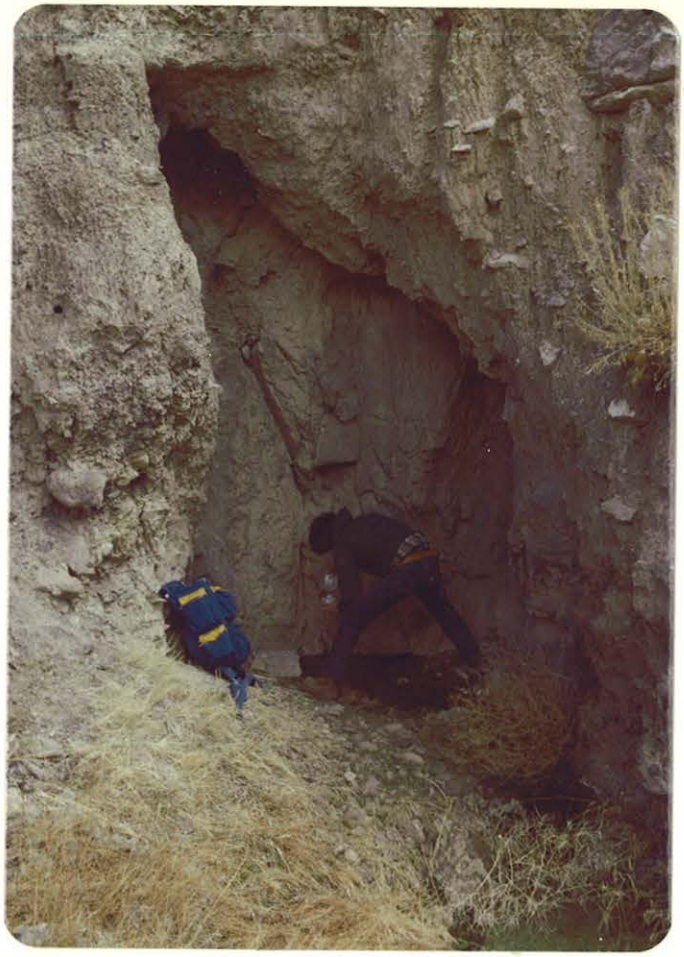
Warm Spring
Floorite mine



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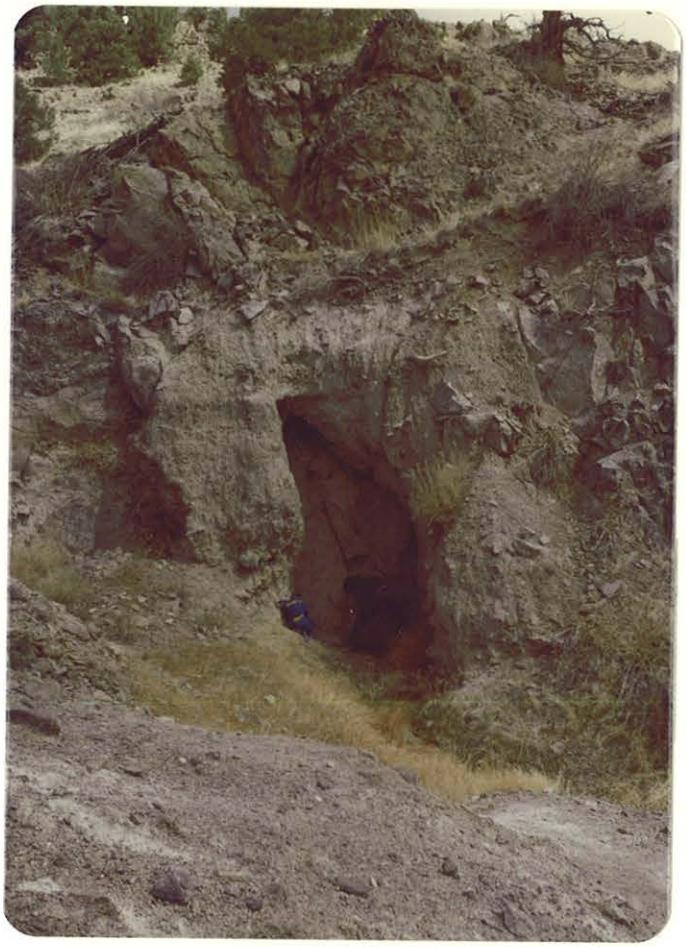

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Canadian American Mine

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Cold Spring on
Lucky Boy Mine Road

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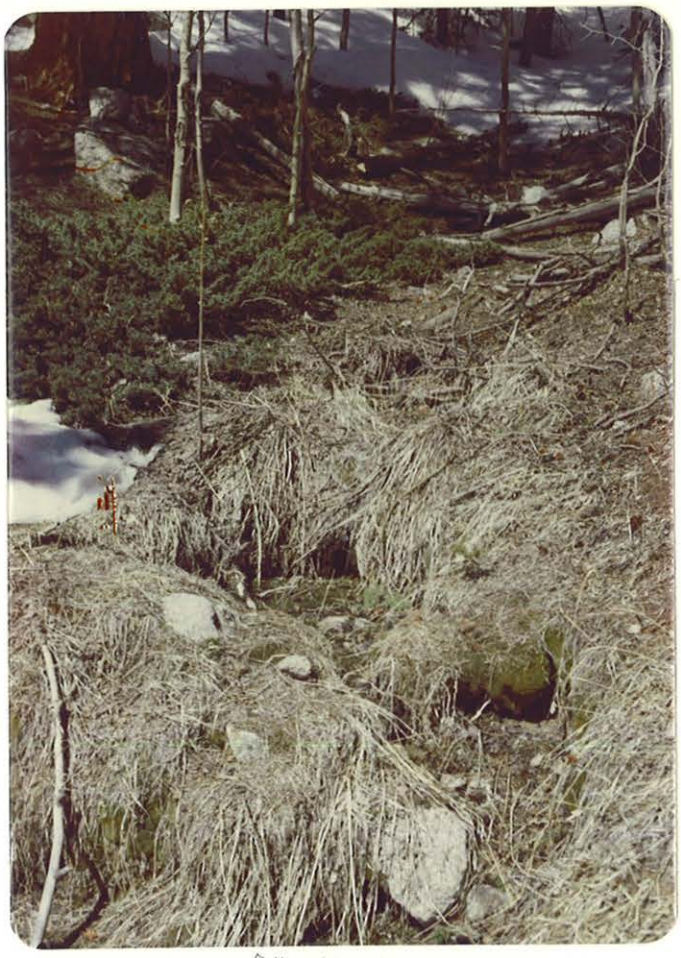

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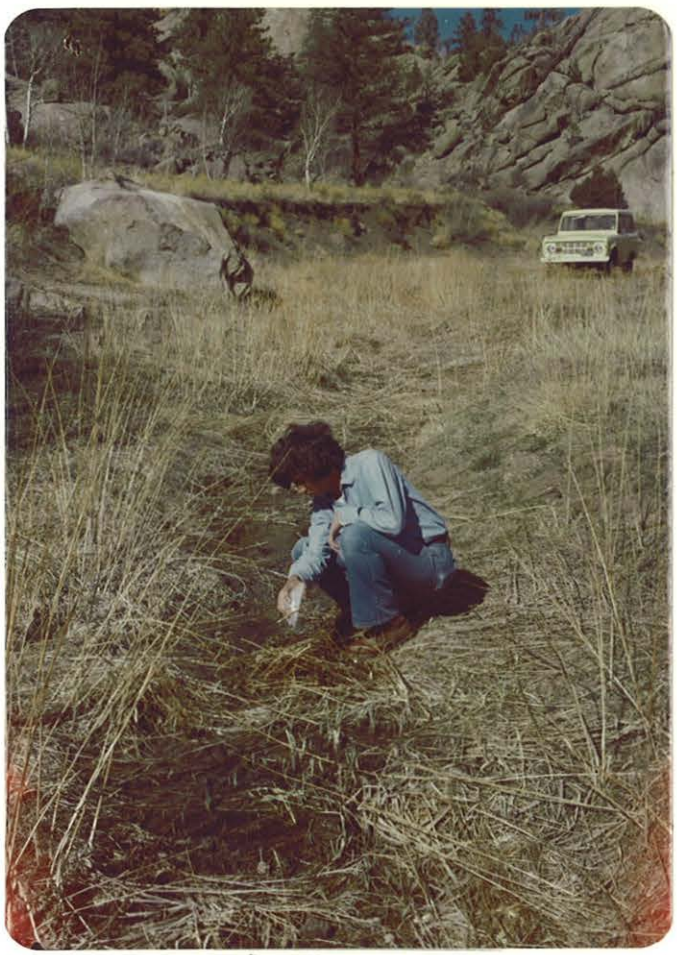
Spring near Chalk Creek



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REFERENCES

Sharp, W.N., 1970, Extensive zeolization associated with hot springs in Central Colorado: U.S.G.S. Professional Paper 700-B, p. B14-B20.

TABLE 1

Chemical Analyses, Calculated Ratios and Subsurface Temperatures for Samples

from the Mt. Princeton area, Chaffee County, Colorado

	Cottonwood Springs X74372	Cottonwood Springs (Sharp,1970)	Cottonwood Springs X74531	Silver Cliff Ranch X74370	Silver Creek Dude Ranch X74532	Mt. Princeton X74328	Middle Mt. Princeton H. S. X74533	Mt. Princeton Hot Springs X74534	Hortense H. S. Mt. Princeton (Sharp, 1970)
ing Temperature° C	43°C	52.2°C	51°C	66°C	53°C	51°C	48°C	56°C	83.8°C
	8.8	8.9	8.4	8.6	8.4	8.0	7.8	8.0	8.9
(ppm)	14.0	13	15.0	17.0	15.0	8.2	6.7	7.9	13
(ppm)	26.0	26	11.5	11.0	11.5	1.0	12.0	59	9.5
$_4$ (ppm)	84.0	98	2	82	96	50	58	54	101
CO_3 (ppm)	32.0	--	66	--	60	50	66	60	--
(ppm)	110	98	200	80	180	50	45	49	94
(ppm)	3	2.5	3	3	3	2	2	2	2.9
iO_2 (ppm)	55.0	52	55	70	65.0	50	50	50	72
(ppm)	5	6.3	6.0	13	4.9	10	40	10.1	3.4
(ppm)	< 1	0.3	0.28	1.3	0.10	< 1	1.46	0.56	0
(ppm)	1.5	--	3	< 1	1.0	0.8	0.5	0.7	--
(ppb)	8.8	--	8.2	80	80	60	50	50	--
(ppb)	3	--	60	1	< 1	3	< 1	< 1	--
(ppb)	120	0	100	100	< 100	< 100	< 100	< 100	--
(ppb)	< 10	--	< 10	< 10	20	< 10	< 10	< 10	--
(ppb)	< 10	0	630	10	< 10	< 10	< 10	< 10	0
SiO_2°C	100°C	98°C	100°C	115	112	96°C	96°C	96°C	118°C
a/K Atomic Ratio	62.3	66.4	113	45.3	102	42.5	38.2	41.6	55.1
Na/K°C	65°C	--	--	105°C	--	109°C	115°C	111°C	80°C
a-K-Ca	0.96	0.87	2.60	1.64	1.25	1.50	0.80	1.49	2.10
Na-K-Ca°C	245°C	250°C	80°C	140°C	195°C	170°C	270°C	170°C	120°C
l/F Atomic Ratio	0.99	1.07	1.41	0.35	0.41	≈0.06	0.95	29.8	0.39
a/Mg Atomic Ratio	≈116	346	757	65	1908	≈53	236	25.9	∞
a/Ca Atomic Ratio	38.3	27	57.9	10.7	63.8	8.7	1.9	8.43	48