

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Audio-magnetotelluric data log and station-location map  
for the Silver Star Hot Springs area, Montana

by

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

During a period of 3 days, 22 audiomagnetotelluric (AMT) soundings were made in the area of the Silver Star Hot Springs, Mont. (fig. 1). These soundings were made to assess the geothermal potential along a northern trend of hot springs from New Biltmore Hot Springs north to Broadwater Hot Springs, Mont.

Scalar resistivities from the data log (table 1) show that thermal waters have probably altered the Cenozoic basin fill to the northeast for at least 4-5 km. Leakage of the geothermal system to the surface is probably taking place along a range-front fault at the contacts between the Precambrian metamorphics on the west and the Cenozoic basin fill on the east. Any potential geothermal system would probably be in the area near the existing hot springs or within a few kilometers to the north or northeast.

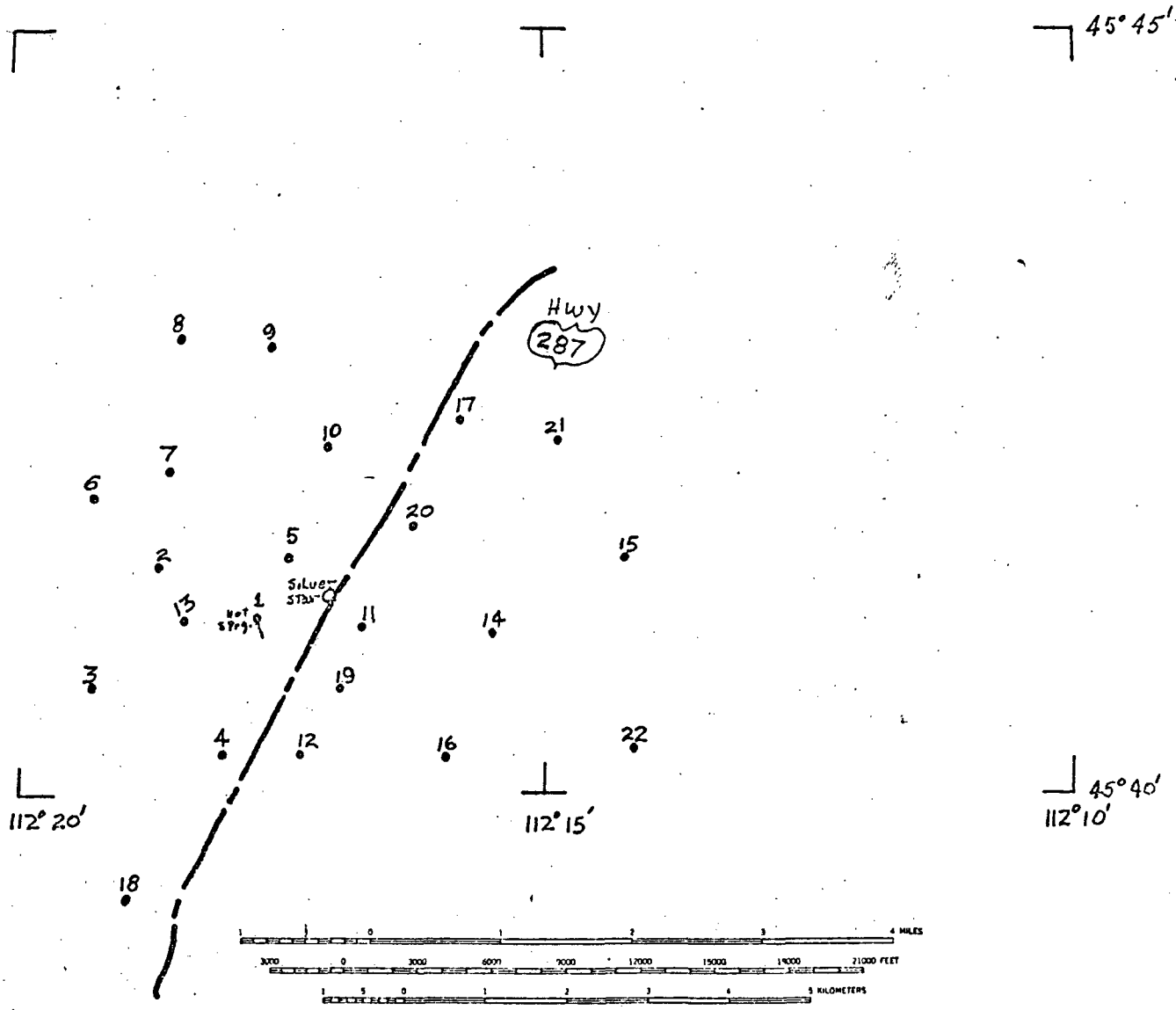


Figure 1  
 Audio-magnetotelluric Station location map of  
 Silver Star Hot Springs area, Montana



Table 1-U.S. GEOLOGICAL SURVEY A.M.T. DATA LOG

Silver Star, Montana  
OCT., 1978

pa = observed apparent resistivity in ohm-meters

N = number of observations

Er = standard error in ohm meters

- = no data

"NOTE" - Telluric-line orientation indicated with station numbers.

Sta. No.		FREQUENCY											
		7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K	18.6K
1NS	pa	72.7	51.9	66.6	34.2	19.8	11.8				55.1	25.3	35.5
	N	7	6	5	6	7	7				6	6	1
	Er	4.86	7.28	11.2	1.74	0.44	0.33				2.75	0.29	-
1EW	pa	39.2	29.4	30.6	17.5	13.4	3.74				25.9	21.8	23.9
	N	6	7	6	7	8	6				9	5	1
	Er	1.44	3.65	2.50	1.78	1.07	0.26				1.60	0.35	-
2NS	pa	132.	99.2	119.	160.	132.	318.				127.	87.0	44.5
	N	7	6	7	7	6	6				7	6	1
	Er	23.1	?	13.0	14.1	15.2	23.5				9.14	1.79	-
2EW	pa	160.	170.	111.	96.2	113.	156.				704.	473.	305.
	N	6	9	8	7	6	7				7	7	1
	Er	19.1	19.7	6.91	4.80	9.96	27.1				58.4	112.	-
3NS	pa	227.	276.	272.	392.	381.	677.				771.	465.	261.
	N	7	7	7	10	7	8				8	9	1
	Er	16.4	36.5	21.8	21.3	23.0	78.6				41.0	16.7	-
3EW	pa	344.	247.	255.	173.	247.	439				482.	414.	256.
	N	6	6	7	10	8	8				8	7	1
	Er	23.0	21.1	16.5	8.14	24.6	129.				11.7	29.0	-
4NS	pa	3080.	2079.	868.	1314.	2884.	1968				740.	992.	1819.
	N	8	10	6	7	6	6				8	1	1
	Er	418.	198.	132.	160.	501.	238.				50.5	-	-
4EW	pa	1061.	1076.	1162.	771.	913.	353.				434.	407.	235.
	N	9	9	8	9	8	7				8	3	1
	Er	104.	102.	93.1	102.	78.1	35.9				18.1	11.2	-

Table 1 - U.S. GEOLOGICAL SURVEY A.M.T. DATA LOG - Continued

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Sta. No.		FREQUENCY										
		7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K
5NS	pa	40.0	36.1	27.9	21.6	14.3	21.0	—	—	75.7	48.4	71.3
	N	7	9	9	7	9	3			10	7	4
	Er	3.67	2.21	1.08	1.74	0.6	0.82			1.30	2.45	—
5EW	pa	7.80	7.43	9.05	6.36	7.54	10.2	—	—	48.3	35.7	26.9
	N	10	8	10	10	10	8			10	1	1
	Er	0.96	0.41	0.62	0.74	0.65	0.39			1.92	—	—
6NS	pa	767.	543.	690.	417.	271.	418.	—	—	206.	176.	85.5
	N	10	8	9	8	8	8			7	3	1
	Er	59.7	44.1	55.4	44.6	16.1	60.7			17.3	9.96	—
6EW	pa	421.	300.	349.	315.	273.	321.	—	—	179.	185.	124.
	N	8	8	10	9	8	8			8	1	1
	Er	31.7	27.1	22.3	27.4	14.0	56.0			7.58	—	—
7NS	pa	369.	287.	449.	313.	245.	293.	—	—	507.	1011.	449.
	N	10	9	10	10	9	10			10	1	1
	Er	75.0	62.5	59.3	46.6	22.2	80.4			24.8	—	—
7EW	pa	439.	347.	263.	184.	274.	303.	—	—	456.	426.	568.
	N	9	10	9	9	9	10			9	1	1
	Er	61.2	39.3	15.8	16.6	44.9	60.5			38.1	—	—
8NS	pa	2436.	1957.	894.	670.	543.	620	—	—	253.	576.	125.
	N	8	9	10	9	8	10			8	1	1
	Er	338.	228.	123.	56.8	27.3	39.9			6.14	—	—
8EW	pa	650.	400.	534.	403.	420.	958.	—	—	277.	206.	191.
	N	8	10	8	8	7	10			6	1	1
	Er	89.2	50.4	35.3	38.6	50.1	257.			9.78	—	—

Table 1 - U.S. GEOLOGICAL SURVEY A.M.T. DATA LOG - Continued

Silver Star, Montana

OCT, 1978

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Sta. No.		FREQUENCY											
		7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K	18.6K
9NS	pa	83.8	50.8	47.4	41.4	22.5	26.4	—	—	—	98.0	40.2	84.7
	N	9	9	9	9	9	10				10	1	1
	Er	13.9	9.88	2.38	2.98	0.76	1.15				7.13	—	—
9EW	pa	13.3	11.1	13.4	10.2	11.6	17.5	—	—	—	69.9	40.0	57.1
	N	12	8	10	10	12	9				12	1	1
	Er	2.16	1.22	1.87	0.59	0.52	1.29				2.88	—	—
10NS	pa	68.6	54.0	42.8	29.7	13.2	25.4	—	—	—	37.8	19.9	40.4
	N	9	9	9	10	9	9				8	1	1
	Er	7.46	7.15	4.38	1.81	0.88	0.97				4.54	—	—
10EW	pa	18.4	15.5	13.9	12.3	13.0	13.3	—	—	—	58.9	36.4	42.0
	N	8	8	8	9	8	9				9	1	1
	Er	0.84	2.43	2.00	0.99	0.75	1.54				4.14	—	—
11NS	pa	37.4	47.2	52.7	35.5	58.4	—	—	—	—	81.3	43.8	80.2
	N	8	9	8	11	9					9	1	1
	Er	2.05	4.81	5.72	2.48	11.2					3.24	—	—
11EW	pa	25.0	62.9	64.7	91.2	140.	—	—	—	—	60.2	59.1	36.8
	N	9	9	8	10	9					8	1	1
	Er	3.00	7.70	6.24	4.00	13.4					5.92	—	—
12NS	pa	42.7	93.6	118.	65.0	37.7	—	—	—	—	86.7	44.5	50.6
	N	6	7	9	8	10	10				9	1	1
	Er	4.43	8.05	39.0	6.57	35.0	1.87				7.55	—	—
12EW	pa	10.4	34.0	36.9	16.6	20.9	22.8	—	—	—	77.0	46.3	61.3
	N	6	6	8	8	8	8				7	1	1
	Er	1.64	3.58	2.31	2.03	1.73	3.43	5			11.0	—	—

Table 1-U.S. GEOLOGICAL SURVEY A.M.T. DATA LOG - Continued

pa = observed apparent resistivity in ohm-meters  
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Silver Star, Montana  
 OCT, 1978

- = no data

"NOTE" - Telluric line orientation indicated with station numbers.

Sta. No.		FREQUENCY											
		7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K	18.6K
13ns	pa	384	410.	231.	399.	792.	1000.	—	—	—	297.	280.	182.
	N	11	7	10	8	10	9				9	1	1
	Er	63.9	64.5	34.8	30.0	35.1	112.				14.7	—	—
13ew	pa	1331.	1295.	1120.	972.	837.	948.	—	—	—	582.	1359.	1051.
	N	9	10	9	8	10	10				9	1	1
	Er	109.	223.	130.	201.	62.5	71.0				21.0	—	—
14ns	pa	55.4	185.	97.5	66.0	70.9	44.6	—	—	—	71.8	39.6	43.3
	N	10	8	11	9	7	6				7	1	1
	Er	12.7	41.5	26.8	8.80	2.77	1.31				1.80	—	—
14ew	pa	25.4	74.4	55.9	137.	105.	36.5	—	—	—	67.5	45.9	36.8
	N	8	8	10	8	9	8				9	1	1
	Er	3.85	16.9	10.5	13.0	7.14	1.30				2.94	—	—
15ns	pa	89.8	74.2	16.4	88.3	73.1	112.	—	—	—	267.	176.	178.
	N	9	9	11	9	9	7				9	1	1
	Er	7.67	16.3	2.48	13.6	6.00	14.4				16.7	—	—
15ew	pa	31.6	21.5	15.9	98.3	129.	40.5	—	—	—	199.	152.	182.
	N	8	7	7	8	9	6				6	1	1
	Er	6.12	3.24	3.12	9.62	4.68	2.19				14.9	—	—
16ns	pa	27.9	71.6	67.3	50.8	25.6	36.7	—	—	—	122.	61.3	36.3
	N	10	9	8	10	8	3				8	6	1
	Er	3.87	10.8	8.25	5.95	1.05	0.18				5.85	2.61	—
16ew	pa	17.8	9.79	17.8	35.8	26.4	—	—	—	—	131.	69.5	46.2
	N	11	9	9	9	9					8	7	1
	Er	2.99	0.92	1.64	4.77	2.08					—	—	—

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 OCT., 1978

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Sta. No.		FREQUENCY											
		7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K	18.6K
17ns	pa	25.9	54.5	26.8	66.2	60.2	—	—	—	—	34.0	21.9	18.4
	N	8	8	8	8	8					7	6	1
	Er	3.46	2.99	5.29	1.98	1.42					2.59	1.01	—
17ew	pa	14.0	8.91	8.58	18.7	29.3	—	—	—	—	22.6	28.5	13.6
	N	8	8	8	8	8					9	1	1
	Er	1.80	1.08	0.62	1.48	0.52					0.96	—	—
18ns	pa	1187.	1066.	1085.	2398.	1822.	1878.	—	—	—	1290.	1716.	363.
	N	8	11	8	8	8	9				7	1	1
	Er	135	102.	181.	446.	215.	167.				82.5	—	—
18ew	pa	3920.	2553.	2279.	2053	1942.	1498.	—	—	—	1309.	442.	356.
	N	10	8	7	9	9	8				8	1	1
	Er	467.	130.	246.	132.	60.5	97.7				90.7	—	—
19ns	pa	28.6	28.1	20.5	16.6	15.3	31.8	—	—	—	76.5	84.4	40.4
	N	8	8	8	8	9	7				8	1	1
	Er	2.70	2.86	1.51	1.24	1.31	0.82				4.70	—	—
19ew	pa	26.3	15.8	16.5	13.3	13.9	19.9	—	—	—	79.5	38.9	48.3
	N	8	9	8	8	9	5				8	1	1
	Er	3.36	1.35	1.56	0.59	0.65	1.16				3.84	—	—
20ns	pa	12.6	18.7	15.6	40.7	41.9	—	—	—	—	53.5	32.0	35.1
	N	8	9	8	8	9					8	1	1
	Er	2.56	2.41	1.86	2.55	1.25					1.04	—	—
20ew	pa	5.56	8.24	12.7	26.9	54.1	—	—	—	—	41.6	25.7	20.5
	N	9	10	8	11	7					8	1	1
	Er	0.29	1.15	1.59	2.96	2.24					2.86	—	—



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Sta. No.		FREQUENCY											
		7.5	10	14	27	76	285	685	1.2K	3.3K	6.7K	10.2K	18.6K
21ws	pa	13.2	20.4	18.5	28.3	23.9	41.2	—	—	—	91.7	65.9	86.6
	N	9	9	8	8	8	9				8	1	1
	Er	0.97	4.03	0.76	2.48	0.76	1.15				3.24	—	—
21ew	pa	7.08	10.4	9.98	12.6	17.9	22.1	—	—	—	86.6	61.8	76.1
	N	8	9	8	9	8	8				9	1	1
	Er	1.08	1.22	0.62	12.6	1.17	1.42				5.28	—	—
22ws	pa	40.7	46.9	68.9	63.0	67.1	166.	—	—	—	538.	164.	564.
	N	9	9	9	10	9	9				8	1	1
	Er	5.39	6.44	6.10	4.71	6.90	12.8				39.5	—	—
22ew	pa	33.1	26.2	45.2	40.9	43.4	95.9	—	—	—	403.	356.	453.
	N	8	12	8	8	9	8				7	1	1
	Er	6.67	4.16	8.02	4.19	2.02	12.9				30.6	—	—
	pa												
	N												
	Er												
	pa												
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	pa												
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	Er												