

AREA
UT
Emery
San Rafael

GLOISZU

USGS T.M.-77

7fc. 6458

cy. 01

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Files

DATE: November 30, 1957

FROM : W. Scott Ross, Geologist
Geologic Branch, ED, 31
TECHNICAL MEMORANDUM 477

W. Scott Ross
By: HOSW.

UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.

SUBJECT: RADIOACTIVE WARM SPRINGS ON THE SAN RAFAEL RIVER, EMERY COUNTY, UTAH

SYMBOL: ED:458

INTRODUCTION

Warm sulphur springs along the San Rafael River were investigated in the summer of 1954 to evaluate their possible relationship to uranium. In addition to the reconnaissance examination a simple test to determine the character of the radioactivity was made by submerging cannal coal and peat in the spring waters.

The springs are located in sections 23 and 24, T. 21 S., R. 13 E., and can be reached by driving northwest from Green River, Utah, on U. S. Highway 50 for about 7 1/2 miles, then turning south for 11 miles on a gravel road to the Tidwell Ranch, and then walking approximately six miles upstream along the San Rafael River. The springs can also be reached from within the San Rafael Swell by way of the Black Dragon Canyon Trail (fig. 1).

PREVIOUS INVESTIGATION

Frank L. Hess investigated the springs in July, 1911, and wrote a short paper. He identified sulphur in small crystals in the spring deposits and noted a strong H_2S odor. In addition he estimated the temperature of the springs to be not over $50^{\circ}C.$ and postulated that the Swell may be underlain by a laccolith.

GEOLOGICAL DESCRIPTION

The springs are located along the San Rafael River in the northeastern portion of the Swell, approximately 2 1/2 miles upstream from the point at which the river breaks through the Eastern Reef into the Green River Desert. Several miles upstream from the springs the river is incised approximately 1,000 feet deep into nearly horizontal sedimentary rocks, having cut nearly to the base of the Coconino sandstone.

1/ Hess, F. L., 1911, A sulphur deposit in the San Rafael Canyon, Utah: U. S. Geol. Survey Bull. 530, pp. 347-349.

Most of the springs originate in the Kaibab limestone and are found near the contact of this limestone with the overlying Moenkopi formation. No evidence of faulting was observed in the area adjacent to the springs.

CHARACTERISTICS OF THE SPRINGS

The area in which the hot springs occur is botanically different from the surrounding region in that there is an abundance of natural vegetation. Willows and grasses extend 35 to 40 feet above the river, while normally they grow only on the valley floor.

The hot springs are located on both sides of the San Rafael River (fig. 2), but only those on the south side were investigated. These ranged in temperature from 66° F. to 73° F. The springs are confined to an area approximately 500 yards long and 50 yards wide. No springs were found more than 25 feet above the elevation of the river. The total number of springs is not known but approximately two dozen were seen, mostly of the tubular type, which probably come from solution passages in underlying limestone. Most of the flowing springs are surrounded by small seeps and gas vents.

Spring No. 1 has a tube about three inches in diameter which is located approximately 20 feet above the river. This spring is exceptional in that the flow bed is a deep reddish-brown, apparently the result of abundant iron oxide. Some radioactivity was detected at this spring. Normal background for the area is .006 MR/HR, and maximum radioactivity at this spring is .01 MR/HR, nearly twice background.

Spring No. 2 has an area of approximately ten square feet with numerous seeps and gas vents. Abundant H₂S was detected, but water flow was small. The abundance of a dark green algae in this spring, which has a water temperature of 70° F., and the lack of algae in spring No. 1 suggests the green algae will not grow below a certain critical temperature. It was observed that algae grew in all the springs that had a temperature of 70° F. or above. Maximum radioactivity here is .013 MR/HR, with a background of .006 MR/HR.

Spring No. 3 is much like No. 2 except for a greater flow of water and a temperature of 72.5° F. Radioactivity is .0075 MR/HR maximum with the same background as at spring No. 2.

Spring No. 4 occurs in an area about 30 yards long and 10 yards wide, near the bank of the river, with numerous vents and seeps. Adjacent to this area quantities of H_2S , and possibly CO_2 , rise to the surface of the river (fig. 2). This spring is believed to have the greatest flow of any in the entire hot spring area, discharging about 20 gallons per minute. The temperature of the water is $73^\circ F.$ and it is depositing sulphur and possibly some sulphate minerals on twigs and rocks. No abnormal radioactivity was detected.

Spring No. 5 appears to have been the most active of all the springs, because of the size of the pool and the volume of gas emitted; however, the rate of flow from this pool was much less than from spring No. 1. It is almost circular and approximately fifteen feet in diameter. The water of this pool is light blue-green, about six feet deep and has a temperature of $73^\circ F.$ Gases are being emitted from ten or more points in the bottom. No anomalous radioactivity was detected.

Around most of the springs large terraces of travertine have been built up. The locations of some inactive springs are marked by cones built of calcareous material that may also contain some sulphate minerals. A river terrace which is present below spring No. 5 is partially covered with a thin travertine deposit.

The material coating twigs and stones within the springs consists of gypsum crystals, many of which were coated with a minute pale yellow granular aggregate. The laboratory reports this material is probably a cobalt iron sulphate associated with gypsum. In addition to these minerals, aggregates of minute sulphur crystals have been identified in the field. An unknown black mineral found in several of the springs has not yet been identified.

Chemical analyses of the water for uranium were made by the U. S. Geological Survey Laboratory in Denver. Two samples taken at spring No. 1 contained 0.048 and 0.056 parts per million uranium. Samples taken at springs 2, 3 and 5 contained 0.006, 0.007 and 0.012 parts per million respectively.

uranium

As spring No. 1 is the only one sampled that contained iron oxide, it seems likely that the presence of iron and uranium may be related.

Precipitation Test

During the spring and summer, 1955, a 25-pound sample of cannel coal and of peat were enclosed in porous canvas bags and left submerged in spring No. 1 for a period of 8 weeks. Both samples showed a trace of ^{238}U by chemical assays, prior to soaking in the spring water; and after the soaking there was no detectable increase chemically or radiometrically.

November 30, 1955

Some iron hydroxides and also an algae scum coated the canvas bags. This test was not satisfactory, because continuous spring water did not flow through the samples. It is also doubtful that the content of uranyl ions in the spring water was high enough to cause precipitation on the coalified material. It is recommended that experiments of this nature not be carried out unless the spring waters contain more than 50 ppm of U_3O_8 .

Attach:

1. Fig. 1 - Location of warm springs in the San Rafael Swall, Emery County, Utah
2. Fig. 2 - Warm springs on the San Rafael River, Emery County, Utah

CC: E. R. Gordon (3)

Library (2) ←

Branch (1)

District (1)

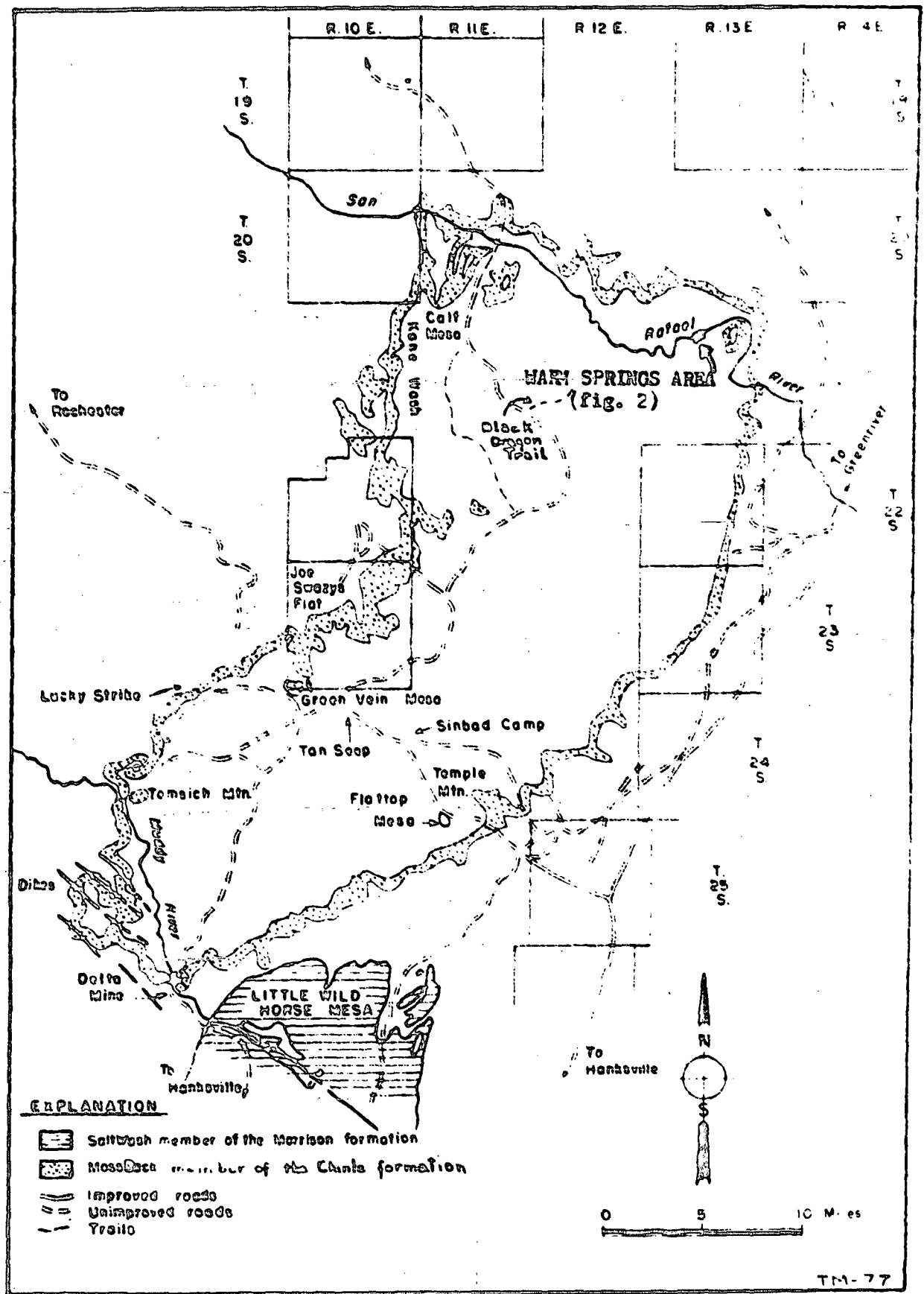


Figure 1. Location of warm springs in the San Rafael Swell, Emery County, Utah

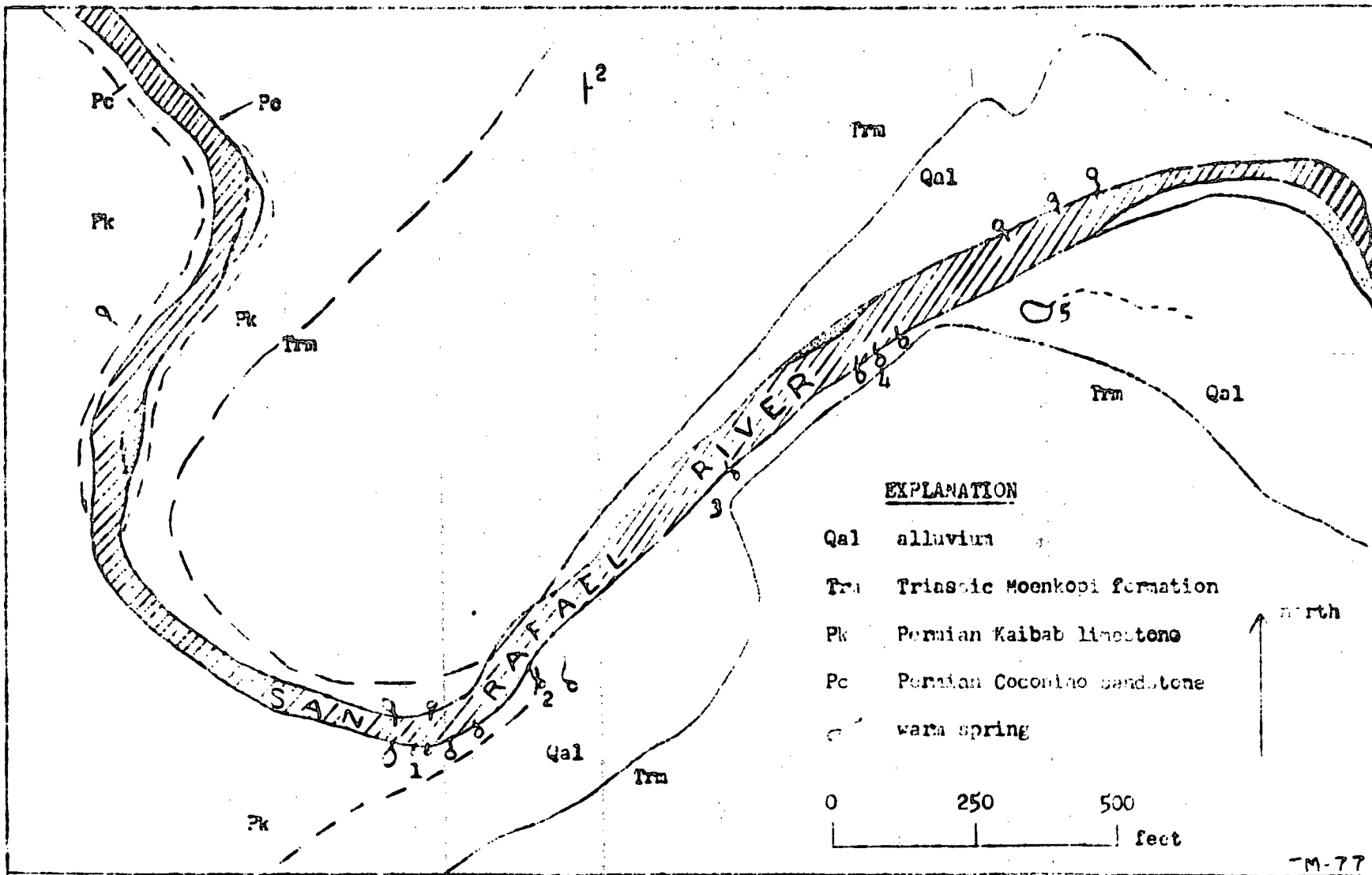


Figure 2. Warm springs on the San Rafael River, Emery County, Utah (location on figure 1)

CONFIDENTIAL

WELL INDUCTION LOG

2

COUNTY EMERY
 FIELD or LOCATION WILDCAT
 WELL FED NO. 8-1 WOODSIDE DOME
 COMPANY SKYLINE OIL CO.

COMPANY SKYLINE OIL COMPANY

WELL FEDERAL NO. 8-1 WOODSIDE DOME

FIELD WILDCAT

COUNTY EMERY STATE UTAH

LOCATION 1365' FSL & 1296' FWL

Other Services:
 FDC-GR, SNP

Sec. 8 Twp. 19 S Rge. 14 E

374

Permanent Datum: GL, Elev. 5033
 Log Measured From KB 13 Ft. Above Perm. Datum
 Drilling Measured From KB

Elev.: K.B. 5046
 D.F. 5033
 G.L.

Date	8-30-70						
Run No.	ONE						
Depth—Driller	6525						
Depth—Logger	6528						
Btm. Log Interval	6522						
Top Log Interval	517						
Casing—Driller	10	3/4 @	517	@	@	@	@
Casing—Logger	517						
Bit Size	8 3/4						
Type Fluid in Hole	F.M.						
Dens.	Visc.	9.4	44				
pH	Fluid Loss	11.5	10. ml	ml	ml	ml	ml
Source of Sample	FLOWLINE						
R _m @ Meas. Temp.	2.54 @ 84 °F	@	°F	@	°F	@	°F
R _{mf} @ Meas. Temp.	.293 @ 84 °F	@	°F	@	°F	@	°F
R _{mc} @ Meas. Temp.	-- @ -- °F	@	°F	@	°F	@	°F
Source: R _{mf}	R _{mc}	M	--				
R _m @ BHT	1.64 @ 130 °F	@	°F	@	°F	@	°F
Time Since Circ.	4 HOURS						
Max. Rec. Temp.	130 °F		°F		°F		°F
Equip.	Location	4544	VERNAL				
Recorded By	BEVAN						
Witnessed By	MESSRS. CAMPBELL & SPJUT						

394

		sh	ss	ls	ke	
0 - 460	460	80	20		5.2	2372
sh 460 - 1660	1200	65	25	10	5.8	6960
sh 1660 - 2580	920	10	90		9.4	8648
sh 2580 - 2840	260	90	10		4.6	1196
sh 2840 - 3590	750	95	5		4.3	3053
sh 3590 - 3860	270	90		10	4.3	1333
sh 3860 - 3990	130	15		90	6.9	897
Cocoyis 3990 - 4405	415	5	95		9.9	4025
Elephant can 4405 - 4530	125				4.0	520
(Permian Carbonates 4530 - 4587)	57		5	90	7.0	13909
Palaeozoic carb to bottom	6522					
						42933

ECU 394

Sec 8, T 19S, R 14E

LOGGED BY GRAHAM CAMPBELL

log begun at surface in Buckhorn -
 art work lousy, so the following
 percentages are ^{wild} guesses. Use other
 values for k_e where available

	fm	thickness	%				
			sh	ss	ls	k_e	
	BUCKHORN	SURFACE TO 460'	80	20		5.2	Prob Kd - maybe Brushy Basin
	SALT WASH	1200	65	25	10	5.8	180' head - prob. incl.; most of Jurassic
Prob. incl. Kayenta - Wingate	NAVAJO	Call this Glen 920 Paria	10	90		9.4	Prob entire Glen Canyon
	CHINLE	Prob OK 260	90	10		4.6	Prob OK
	SHINARUMP	710	95	5		4.3	} Prob all malenkapi
	SINBAD	310	90		10	4.3	
	KAIBAB	130	15		85	6.9	Prob OK
	COCONINO	415	5	95		9.7	Prob white Rim + Cedar Mesa
	ELEPHANT CAN.	130	100			4.0	} Probably Cutler through Honaker Tr.
Perm	PALEOZOIC PERM CARB	1987	5	5	90	7.0	

TD 6522 IN PALEOZOIC CARB

1980
 130

 2110

BHT

130°F @ 6522' $k_e = 6.6$ millical
 cm sec °C

394

surface to Glen Can Gr.

$$\begin{array}{r|l} 460' @ 5.2 & 2392 \\ 1200' @ 5.8 & 6960 \\ \hline \textcircled{1660} & 9352 \end{array}$$

$$k_e = 5.6$$

Chinle to Kaibab

$$710 @ 4.3$$

$$310 @ 4.3$$

$$\textcircled{1020}$$

$$k_e = 4.3$$

Kaibab to Honaker

$$415 \times 9.7 \quad | \quad 4025.5$$

$$130 \times 4.0 \quad | \quad 520$$

$$1987 \times 7.0 \quad | \quad 13909$$

$$\textcircled{2532}$$

$$\hline 18454.5$$

$$k_e = 7.3$$

UGMS
EMERY CO., UT

all except
8 + 19 are
51° F amb.

	Sec	T	R	DEPTH	°F
✓ ①	24	14S	6E	4168	96 ✓
✓ ②	24	14S	6E	4141	95 ✓
				4603	99 ✓
✓ ③	6	14S	7E	5460	135 ✓
✓ ④	19	14S	7E	4088	110 ✓
✓ ⑤	30	14S	7E	3718	98 ✓
✓ ⑥	32	14S	7E	4457	80 ✓
				4870	85 ✓
✓ ⑦	5	15S	7E	4891	102 ✓
✓ ⑧	9	16S	7E	4200	100 ✓
				4496	102 ✓
				5449	124 ✓
✓ ⑨	21	16S	13E	6505	130 ✓
✓ ⑩	25	16S	14E	986	104 ✓
				5402	140 ✓
				9620	145 ✓
				11242	168 ✓
				12586	185 ✓
✓ ⑪	15	17S	8E	6832	120 ✓
				10638	160 ✓
				11241	161 ✓
✓ ⑫	30	18S	14E	7082	122 ✓
✓ ⑬	12 SE	19S	13E	4104	96 ✓
				8424	130 ✓
✓ ⑭	29 SW	19S	12E	6030	108 ✓
✓ ⑮	35	19S	14E	3740	110 ✓

51° F
53.8

[Signature]

EMERY Co p2

	Sec	T	R	DEPTH	°E
✓	(16) 35 NW	19S	14E	6902 ^{12.46}	137 ✓
				8739	141 ✓
✓	(17) 21 NE	20S	7E	6455 ^{12.55}	132 ✓
				9980 ^{11.62}	167 ✓
✓	(18) 22	20S	7E	3386	101 ✓
✓	(19) 16 NW	21S	6E	4947 ⁴⁸	113 ✓
✓	(20) 32 SE	21S	13E	4620	90 ✓
✓	(21) 9 NE	21S	7E	2041 ^{10.98}	73 ✓
				3502	95 ✓
✓	(22) 24 SW	21S	15E	6573 ^{11.26}	125 ✓
				9594 ✓	150 ✓
				10605 ✓	154 ✓
SEVIER CO	34 SEVIER CO	22S	5E	4787 ^{11.4}	120 ✓
				10744	179 ✓
✓	(23) 5	22S	12E	4182	94 ✓
✓	(24) 24 NE	22S	13E	6758	116 ✓
✓	(25) 9 NE	22S	15E	8987	140 ✓
✓	(26) 26	22S	15E	8485	140 ✓
✓	(27) 28	22S	15E	7935	176 ✓
✓	(28) 17 SW	23S	9E	3666	95 ✓
X ✓	(29) 7	23S	13E	2214	95 ✓
	15 GRAND CO	23	19	4380	117 ✓
	11 GRAND CO	23S	19E	6104	105 ✓
✓	(30) 19	23S	14E	6061	118 ✓
✓	(31) 21	23S	15E	5636	116 ✓
✓	(32) 3	23S	16E	5504 ^{11.8}	116 ✓
				9449	145 ✓

51' and 19.9

UGMS - EMERY P 3

	Sec	T	R	DEPTH	°F	°
✓	(33) 15	23 S	16 E	8440	138	✓
✓	(34) 14	24 S	9 E	3245	81	✓
✓	(35) 28	24	10 E	4189	112	✓
✓	(36) 2	24	13	4471	89	✓
				4471	98	✓
X	(37) 21	24 N	14 W	1462	80	51° and 19.8
				2391	96	NO OBS
				7640	162	✓
✓	(38) 5	24	15	3718	83	✓
✓	(39) 15 NE	24	16	4616	95	✓
✓	(40) 19	24	16	5325	105	✓
✓	(41) 1 SE	25 S	12 E	2354	86	✓
X	(42) 24	25 S	12 E	2530	102	51 and 20.2
				5931	120	✓
✓	(43) 34 SW	25 S	12 E	6009	145	✓
✓	(44) 11 NW	25	13	5172	105	✓
✓	(45) 14	25 S	13 E	4725	119	✓
				7313	139	✓
↓	(46) 22 SW	25	14	6994	122	✓
✓	(47) 32 SW	25 S	15 E	1393	85	51 and 24.4
				4880	101	✓
				5987	120	✓
✓	(48) 10	25 S	16 E	4543	104	✓
				7384	134	✓
✓	(49) 29	25 S	16 E	6697	132	✓
✓	(50) 17	26	13 E	2706	90	✓

EMERY P Y

Sec	T	R	DEPTH	°F	
✓ (51) 25	26S	13E	6378	107	✓
✓ (52) 35	26S	13E	6041	116	✓
✓ (53) 7 NW	2SS	14E	5742	138	✓
✓ (54) 26 SE	26S	14E	6700	117 ³⁴	✓
			3944	117	✓
✓ (55) 30 SW	26S	14E	6002	123	✓
(56) 5 SW	26S	17E	6461	109	✓

plotted

EMERY COUNTY - METRIC

TOTAL ALL WELLS: 60

TOTAL ANOM. WELLS: 6

Sec	T	R	(m) Depth	°C	°C/m	°C AMB
17	20S	7E	489	34.4	49	10.6
25	16S	14E	300	40.0	98	↓
7	23S	13E	675	35.0	36	
21	24S	14E	446	26.7	36	
24	25S	12E	771	38.9	37	
32	25S	15E	425	29.4	44	

EMERY CO.

P.I.

102 ○
 103 ○
 105 ○
 107 ~~○~~ ▲ 48.9°C/hour

UGMS

<u>No</u>	<u>No</u>	<u>No</u>
1 ○	21 ○	41 ▲
2 ○	22 ○	42 ▲ 36.7°C/hour
3 ○	23 ○	43 ○
4 ○	24 ○	44 ○
5 ○	25 ○	45 ○
6 ○	26 ○	46 ○
7 ○	27 ○	47 ▲ 44.5°C/hour
8 ○	28 ○	48 ○
9 ○	29 ▲ 36.2°C/hour	49 ○
10 ▲ 98.0°C/hour	30 ○	50 ▲
11 ○	31 ○	51 ○
12 ○	32 ○	52 ○
13 ○	33 ○	53 ○
14 ○	34 ○	54 ○
15 ○	35 ○	55 ○
16 ○	36 ○	56 ○
17 ○	37 ▲ 36.2	
18 ○	38 ○	
19 ○	39 ○	
20 ○	40 ○	

PI.

GARFIELD CO.

No

159 ○

161 ○ 39.0 °C/hr

162 ○

163 ○

✓ 164 △

✓ 165 △

✓ 166 △

UGM'S

No

1 ○

✓ 17 △

33 ○

2 ○

18 ○

34 ○

3 ○

19 ○ SAME AS 1

35 ○

4 ○

20 ○

✓ 36 △

5 ○

✓ 21 ○

✓ 37 ▲ 51.3 °C/hr

6 ○

✓ 22 △ 39.6 °C/hr

✓ 38 △

7 ○

23 ○

39 ○

8 ○

24 ○

40 ○

9 ○

25 ○

41 ○

10 ○

26 ○

42 ○

11 ○

27 ○

43 ○

12 ○

28 ○

44 ○

13 ○

29 ○

45 ○

14 ○

30 ○

46 ○

15 ○

31 ○

47 ○

16 ○

32 ○

48 ○

UGMS
GARFIELD CO p 1

also 19	Sec	T	R	Depth	F	
✓ ①	24	36 S	1 E	7004	122	✓ 48
✓ ②	36	31 S	7 E	6645	98	✓ 48
✓ ③	22	31 S	9 E	6803	114	✓ 48
✓ ④	27	31 S	11 E	6675	128	✓ 51
✓ ⑤	19	31 S	15 E	3198 ¹²²	90	✓ 51
				4305	98	✓
✓ ⑥	24	33	9 E	6240	110	✓ 51
✓ ⑦	24	34 S	7 E	5624	136	✓ 51
✓ ⑧	2	34 S	9 E	9678	158	✓ 51
✓ ⑨	22 SE	35 S	2 W	7702 ^{13.5}	152	✓ 48
				10090 ^{16.15}	214	✓
				10249	200	✓
✓ ⑩	35	35 S	2 W	10678 ^{10.12}	150	✓ 48
				11179 ^{10.8}	169	✓
✓ ⑪	22	35 S	2 W	3224 ^{13.0}	106	✓ 48
				7153	158	✓
				7302	146	✓ 48
✓ ⑫	27	35 S	2 W	7520 ^{12.0}	138	✓ 48
				8694 ^{12.1}	160	✓
✓ ⑬	10	35	3 E	4398	103	✓ 48
✓ ⑭	20	35	3 E	5092	110	✓ 48
✓ ⑮	29	35	3 E	5982 ^{10.4}	110	✓ 48
				6920	112	✓
✓ ⑯	18	35	5 E	4408	97	✓ 51
✓ ⑰	32 NE	35	5 E	3145	101	✓ 51

B G M S
GARFIELD CO p 2

	Sec	T	R	Depth	°F		
✓ 18	11 NE	36 S	1 E	7240	127	✓	48
19	24 NE	36 S	1 E	7006	122	✓	48 <small>class #1</small>
✓ 20	11	36 S	1 E	7635	128	✓	48
✓ 21	11	36 S	1 E	6324	125	✓	48
✓ 22	12	36 S	1 E	1520	81		48
				6504	155	✓	
				8704	170	✓	
				10098	160	✓	
✓ 23	12 SW	36 S	1 E	6560	136	✓	48
✓ 24	13 NW	36 S	1 E	6650	137	✓	48
				7503	144	✓	48
				9174	142	✓	
✓ 25	13 SW	36 S	1 E	6646	116	✓	48
				6811	140	✓	
✓ 26	14	36 S	1 E	8086	128	✓	48
				8089	133	✓	
✓ 27	24	36 S	1 E	7612	114	✓	48
✓ 28	36	36 S	1 E	7081	119	✓	48
✓ 29	31 SW	36 S	2 E	7070	125	✓	48
✓ 30	15 SW	36 S	3 E	5834	96	✓	48
✓ 31	24	36 S	1 E	6699	120	✓	48
✓ 32	24 SW	36 S	1 E	6645	129	✓	48
✓ 33	25 NE	36 S	1 E	6699	126	✓	48
✓ 34	25 SE	36 S	1 E	7125	120	✓	48
✓ 35	31 SW	36 S	2 E	7069	125	✓	48
✓ 36	17	36 S	5 E	3124	85	✓	51

UGMS
GARFIELD COUNTY P-3

SEC	T	R	DEPTH	T ° F	
✓ 37 17 SW	36 S	6 E	1742	100.51	ok at 51 amb 51
			5583	95	✓
✓ 38 18	36 S	6 E	3010	93	✓ 51
✓ 39 18 SE	36 S	10 E	5628 10.17	142	✓ 51
			8362	160	✓
✓ 40 10 NW	36 S	4 W	6419	154	✓ 48
			11147 10.76	168	✓
✓ 41 1 NE	36 S	4 1/2 W	4756 ✓	96	✓ 48
			6245	116	✓
✓ 42 6	37 S	2 E	7217	126	✓ 48
✓ 43 6 NW	37 S	2 E	7155	135	✓ 48
✓ 44 7 SE	37 S	2 E	7318	132	✓ 48
✓ 45 7	37 S	2 E	9950	140	✓ 48
✓ 46 8 NW	37 S	2 E	6823 10	118	✓ 48
			7114	124	✓
✓ 47 17 SE	37 S	5 E	4096	85	✓ 51
48 2	37 S	7 W	4969	99	✓ 51

1 and 19 duplicates
plotted
47 total

GARFIELD CO

No. ALL WELLS: ~~55~~ 54

" ANOMALOUS " : 3

See	T.	R.	d (mm)	°C	°C/In	Amb
27	35S	2W	1993	86.7	39	8.9
12	36S	1E	463	27.2	39	8.9
17	36S	6E	531	37.8	51	10.6