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A NOTE ON GEOTHERMAL INDICATORS IN SOUTHERN HUDSPETH AND CULBERSON COUNTIES, TEXAS

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INTRODUCTION

From September 1975 until August 1979, the Department of Geological Sciences at the University of Texas at El Paso was involved in a program to explore for geothermal energy resources in Trans-Pecos Texas. The program consisted of sampling all available springs, wells and tanks fed by windmills to: 1) locate hot surface waters, and 2) locate hot subsurface waters by use of the silica geothermometer. This paper summarizes the results obtained for the area traversed by the New Mexico Geological Society field conference; results for the entire Trans-Pecos area are reported by Hoffer (1979).

HOT SURFACE WATERS

For this report, thermal water is defined as water with a temperature equal to or exceeding 30°C. This value is some 7° above the average subsurface water temperature in West Texas and 11° above the mean annual air temperature.

Eleven thermal water occurrences are located in the field trip area (fig. 1). The largest concentration of thermal springs is at Indian Hot Springs where five of eight springs discharge water at

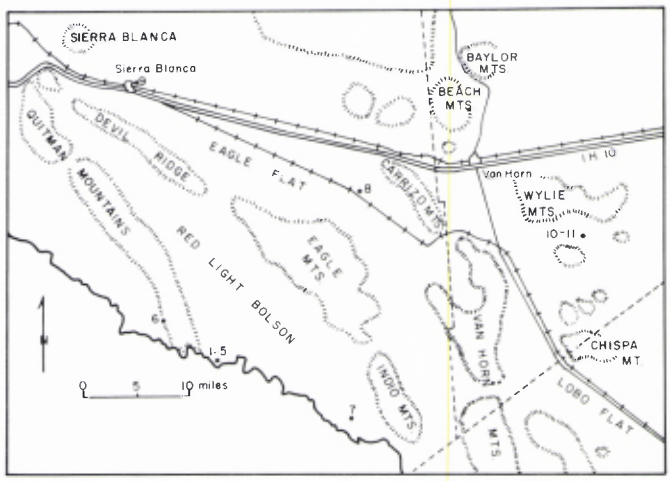

Figure 1. Index map of thermal water occurrences in southern Hudspeth and Culberson Counties, Texas (I-5 Indian Hot Springs, 6-Red Bull Springs, 7-Southern Hudspeth Well, 8-Hot Wells, 9-Sierra Blanca Well, 10-11 wells south of Van Horn).

Table 1. Chemical analyses of thermal waters in southern Hudspeth and Culberson Counties (numbers refer to locations in Fig. 1; all elements are reported in ppm) (from Hoffer, 1978).

Sample Location	1	2	3	4	5	6	7	8	9	10	11	Average of West Texas Waters (1028 samples)
pH	6.8	7.1	7.1	7.0	7.1	8.1	8.0	7.6	7.0	7.1	7.2	7.3
Temperature (°C)	46	33	38	44	32	34	35	40	38	32	30	23.2
Na	2240.00	2430.00	2130.00	2210.00	2080.00	367.00	90.60	103.00	596.00	80.00	131.00	166.90
K	135.00	95.00	113.00	77.00	122.00	8.80	3.50	1.80	28.00	1.80	1.00	9.30
Ca	135.00	138.00	143.00	131.00	127.00	7.50	18.20	6.00	90.90	67.20	40.20	115.30
Si	21.00	20.00	25.00	22.00	25.00	19.00	9.80	10.00	13.60	14.00	26.00	18.40
Cl	3000.00	3100.00	2800.00	2700.00	2775.00	88.00	14.00	2.00	608.00	62.00	38.00	194.70
F	2.20	1.90	1.70	1.60	2.10	2.60	0.30	1.70	1.10	0.90	2.70	1.40
Li	2.70	2.80	2.40	2.40	2.50	0.03	0.07	0.03	0.38	0.10	0.00	0.10
Mg	38.40	37.70	33.60	31.90	37.40	1.20	4.30	1.00	34.20	16.70	26.00	31.40
Br	2.60	1.92	n.d.	2.29	1.85	0.14	0.24	0.21	3.20	0.10	0.42	1.51
I	0.04	0.06	0.01	0.03	0.07	0.02	0.02	0.21	0.02	0.01	0.00	0.01
Fe	0.27	0.19	0.55	0.41	0.23	0.00	0.61	0.70	0.05	0.54	0.61	1.50
Sr	2.70	2.67	2.71	2.64	2.81	0.74	0.77	0.70	2.41	0.94	0.76	2.90
Mn	0.32	0.27	0.29	0.37	0.05	0.00	0.00	0.01	0.00	0.03	0.02	0.10
Pb	0.02	0.00	0.04	0.00	0.00	0.00	0.02	0.00	0.00	0.04	0.03	0.03
Zn	0.02	0.00	0.01	0.00	0.01	0.00	0.07	0.03	0.04	0.59	0.15	0.35
Cu	0.02	0.00	0.00	0.03	0.00	0.00	0.01	0.01	0.00	0.01	0.03	0.03
Cd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ag	0.02	0.00	0.00	0.01	0.01	0.00	0.02	0.00	0.04	0.00	0.00	0.00
Ba	0.01	0.01	0.11	0.11	0.01	0.11	0.11	0.00	0.01	0.00	0.11	0.12
Total Dissolved Solids	9000	9500	8400	8300	8800	1400	310	320	2700	480	570	1290

30°C or above. These springs have been discussed in detail by Reaser and others (1975). Chief Springs discharges the hottest water at a temperature of 46°C. All the thermal waters at Indian Hot Springs have in common the facts that: 1) they are slightly saline, containing 8,300 to 9,500 ppm total dissolved solids; 2) major dissolved solids include sodium and chlorine; and 3) they contain moderately high values of lithium, 2-3 ppm. A complete listing of water chemistry for the thermal occurrences is given in Table 1.

Other thermal water occurrences have been found at Red Bull Springs, in a city well at Sierra Blanca, in two wells southeast of Van Horn and at Hot Wells (fig. 1). During the third day of the field trip we will pass by Hot Wells. Here, two wells were drilled by the Southern Pacific Railroad along their right-of-way in Eagle Flat. The wells are approximately 300 m deep and produce water from basin fill (Reaser and others, 1975). Only one well was available for sampling; its water temperature was 40°C (Hoffer, 1979).

Table 2. Surface temperatures, silica concentrations and estimated silica temperatures of thermal water occurrences, southern Hudspeth and Culberson Counties (thermal occurrence numbers refer to locations on Figure 1).

Thermal Occurrence	Surface Temperature(°C)	Silica Concentration (ppm)	Estimated Silica Temperature (°C)
1	46	21	96
2	33	20	88
3	38	25	105
4	44	22	98
5	32	25	105
6	34	19	85
7	35	10	65
8	40	10	65
9	38	14	80
10	32	14	80
11	30	26	108

HOT SUBSURFACE WATERS

One method used to estimate the temperature of water at depth is to measure the amount of dissolved silica. The direct relationship between the amount of dissolved silica and the minimum water temperature at depth constitutes what is called the silica geothermometer (Fournier and Rowe, 1966).

Silica concentrations and the corresponding calculated minimum surface water temperatures of the thermal waters in this area are included in Table 1. The numbers correspond to the thermal occurrences shown on Figure 1. The calculated subsurface temperature values range from 65° to 105°C; they average about 89°C.

CONCLUSIONS

Exploration for geothermal resources in southern Hudspeth and Culberson Counties indicates the presence of a number of thermal wells and springs. Temperatures of the thermal waters range from 30° to 46°C. Based on the concentrations of dissolved silica, calculated subsurface water temperatures do not appear to be high enough to produce steam for generating electricity. Subsurface temperatures of at least 200° to 250° would be needed to make the area favorable for geothermal development.

REFERENCES

Fournier, R. O. and Rowe, J. J., 1966, Estimation of underground temperatures from the silica content of water from hot springs and wet-steam wells: American Journal of Science, v. 264, p. 685-697.

Hoffer, J. M., 1978, Thermal water occurrences in Trans-Pecos Texas: Texas Journal of Science, v. 30, p. 309-319.

———, 1979, Geothermal exploration of western Trans-Pecos Texas: Texas Western Press, 50 p.

Reaser, D. F., Underwood, J. R. and Jones, B. R., 1975, Geothermal prospects of the Eagle-Quitman Mountains and vicinity, Trans-Pecos Texas: West Texas Geological Society Guidebook 75-15, p. 155-161.