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GEOLOGICAL SURVEY

BASIC DATA FROM FIVE CORE HOLES IN THE RAFT RIVER GEOTHERMAL AREA, CASSIA COUNTY, IDAHO

Prepared in cooperation with the
Idaho Department of Water Resources

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INTRODUCTION

Studies of the geothermal aspect of the Bridge area of the Raft River basin in south-central Idaho (fig. 1) by the U.S. Geological Survey began in 1972 when Young and Mitchell (1973) made a geochemical and geologic reconnaissance of selected thermal waters in Idaho. The Bridge area had been designated the Frazier known geothermal resource area (Frazier KGRA) by the U.S. Geological Survey (Godwin and others, 1971). Since 1972, several units of the Geological Survey have studied the area to provide data for the U.S. Energy Research and Development Administration, which proposes to ascertain whether the geothermal resource can be developed for power generation and other uses. The studies include geologic mapping, geophysical surveys, water sampling, test drilling, and studies of all available drill-hole data. A list of reports already prepared on the area is included with this report.

Core drilling of five holes began in August 1974 and was completed in March 1975. These holes are referred to as intermediate-depth core holes, principally because in the spring of 1974, 35 auger holes 25 to 98 feet (7.6 to 30

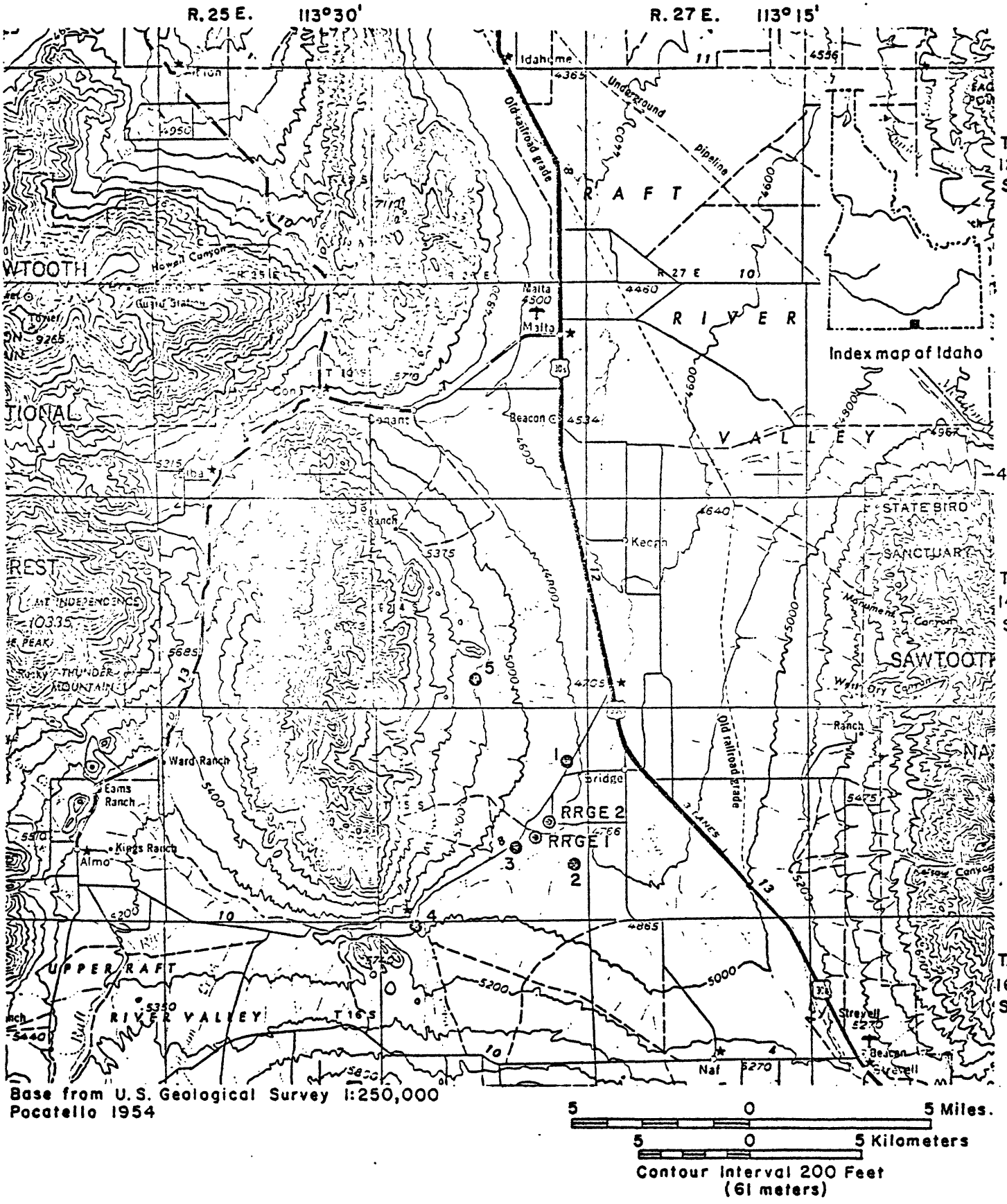

Figure 1.--Map showing location of core holes 1-5 and Raft River geothermal experimental wells RRGE 1 and RRGE 2.

meters) were completed in the area (Crosthwaite, 1974), and the Aerojet Nuclear Company, under the auspices of the U.S. Energy Research and Development Administration, was planning some deep drilling 4,000 to 6,000 feet (1,200 to 1,800 meters) (fig. 1). The purpose of the core drilling was to provide information to test geophysical interpretations of the subsurface structure and lithology and to provide hydrologic and geologic data on the shallow part of the geothermal system. Samples of the core were made available to several divisions and branches of the Geological Survey and to people and agencies outside the Survey. This report presents the basic data from the core holes that had been collected to September 1, 1975, and includes lithologic and geophysical well logs, chemical analyses of water (table 1), and laboratory analyses of cores (table 2) that were completed as of the above date. The data were collected by the Idaho District office, Hydrologic Laboratory, Borehole Geophysics Research Project, and Drilling, Sampling, and Testing Section, all of the Water Resources Division, and the Branch of Central Environmental Geology of the Geologic Divison.

The work was funded in part by, and performed in cooperation with, the Idaho Department of Water Resources. Aerojet Nuclear Company and the U.S. Energy Research and Development Administration cooperated informally in the work.

All studies by the Geological Survey since September 1973 in the Bridge and adjacent areas and planned future studies are directed toward the evaluation of the magnitude of the geothermal resource, to definition of its geologic and hydrologic controls, and to the relation between the geothermal and cool-water systems. Additional test drilling, geologic and geophysical subsurface studies, mathematical modeling, and isotope work are planned or are in progress.

One important fact not discovered in the core drilling should be noted. The Earthquake Hazards Branch of the U.S. Geological Survey drilled a 1,300-foot (396-meter) deep hole about 100 feet (30 meters) northwest of core hole 5 as part of their heat-flow studies. Quartz monzonite was found at approximately the same depth in both holes. However, after drilling about 85 feet (26 meters) of the quartz monzonite, the formation changed to silts and clays of the Salt Lake Formation.

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Table 1

Well data and water-quality analyses of core holes, Raft River geothermal studies, 1974-75

(Core-hole diameter is nominal 4 inches or 100 millimeters)

WELL NUMBER		14S-26E-33aabl	15S-26E 12accl	15S-26E 12accl	15S-26E-12accl	15S-26E-12accl	15S-26E-12accl	15S-26E-12accl	15S-26E-22dddl	15S-26E-22dddl	15S-26E-22dddl	15S-26E-22dddl	15S-26E-25acal	15S-26E-25acal	16S-26E-5bba3	16S-26E-5bbS1
Well Number (Field)		5	1	1	1	1	1	1	3	3	3	3	2	2	4	Warm spring
Well Depth (Feet)[5]		719	1,101	1,101	1,101	1,101	1,101	1,101	1,423	1,423	1,423	1,423	800	800	252	-
Depth of Casing (Feet)		101	283	283	283	283	283	283	198	198	198	198	211	211	61	-
Date Drilling Completed		03/15/75	08/31/74	08/31/74	08/31/74	08/31/74	08/31/74	08/31/74	11/22/74	11/22/74	11/22/74	11/22/74	10/15/74	10/15/74	02/19/75	-
Date Sample Collected		03/28/75	09/05/74	09/06/74	09/06/74	09/07/74	12/05/74	12/06/74	12/06/74	01/13/75	[1]03/31/75	[2]04/01/75	10/17/74	01/14/75	03/29/75	09/14/74
Packer or Screen Set (Feet)		None	900	595	440	283	None	400	None	955	400	400	650	650	None	-
Interval Sampled (Feet)		101-719	900-1,101	595-1,101	440-1,101	283-1,101	283-1,101	283-400	198-1,423	955-1,423	198-400	198-400	645-650	645-650	61-252	-
Discharge (gpm)[6]		25	10	10	10	10	10	10	50	25	10	10	15	22	25	45
Type of Lift		Swab	Air	Air	Air	Air	Turbine	Turbine	Flow	Flow	Turbine	Turbine	Swab	Swab	Swab	-
CONSTITUENT	REPORTING UNIT															
Silica	[3]mg/l	38	85	85	84	82	88	60	56	51	39	48	41	88	37	68
Iron	[4]µg/l	310	230	40	50	40	220	210	40	10	10	10	-	30	30	-
Manganese	µg/l	80	230	210	250	290	130	250	58	30	40	20	-	190	520	-
Calcium	mg/l	39	240	230	230	310	300	140	56	56	55	59	51	35	58	55
Magnesium	mg/l	7.5	2.1	2.5	2.9	3.1	1.4	17	0.5	0.4	0.5	0.6	9.0	3.9	9.0	5.8
Sodium	mg/l	28	2,000	1,500	1,500	1,800	2,000	400	1,300	1,300	1,100	1,200	330	370	240	260
Potassium	mg/l	4.3	270	200	210	270	270	40	14	13	11	13	14	34	13	15
Bicarbonate	mg/l	161	83	93	83	70	58	131	63	73	69	54	179	176	138	123
Carbonate	mg/l	0	-	-	-	-	-	-	-	0	-	0	-	0	0	-
Alkalinity as $CaCO_3$	mg/l	132	-	-	-	-	48	107	52	2	57	44	147	144	113	-
Sulfide	mg/l	1.0	-	-	-	-	1.0	1.0	1.7	1.0	-	-	-	1.0	2.9	-
Sulfate	mg/l	15	47	49	45	43	45	31	52	51	49	54	78	32	44	41
Chloride	mg/l	61	3,600	2,800	2,800	3,500	3,900	890	2,000	2,100	1,700	1,800	470	570	380	430
Fluoride	mg/l	0.6	4.0	3.2	3.1	3.2	3.9	0.8	5.0	5.1	5.2	4.9	2.3	2.8	4.4	4.6
Bromide	mg/l	0.2	0.5	4.2	4.0	6.5	7.2	1.6	4.1	4.1	3.7	0.6	-	1.0	0.9	-
Iodide	mg/l	-	0.06	0.03	0.04	0.06	-	-	-	-	-	-	-	-	-	-
Nitrite Plus Nitrate, as N	mg/l	0.16	3.5	0.23	0.53	0.33	0.09	0.18	0.07	0.09	0.01	0.01	0.03	0.12	0.04	0.13
Nitrogen as Ammonia	mg/l	1.5	-	-	-	-	2.6	0.70	0.70	5.3	-	1.5	-	6.5	1.0	-
Phosphorus Total	mg/l	0.04	0.07	0.08	0.10	0.16	0.04	0.05	0.04	0.04	0.01	0.03	-	0.05	-	0.07
Dissolved Solids, Calculated Sum	mg/l	274	6,310	4,930	4,930	6,060	6,650	1,650	3,520	3,590	3,000	3,210	1,080	1,230	856	942
Dissolved Solids	tons/acre-ft	0.37	9.06	6.62	6.87	8.69	9.04	2.24	4.79	4.88	4.08	4.37	1.47	1.67	1.16	1.28
Hardness as $CaCO_3$	mg/l	130	610	590	590	790	760	420	140	140	140	150	160	100	180	160
Noncarbonate Hardness	mg/l	0	540	510	520	730	710	310	93	140	84	110	18	0	69	63
Percent Sodium	%	31	82	80	79	78	80	65	95	95	94	94	80	85	72	76
Sodium-Adsorption Ratio	-	1.1	35	27	27	28	32	8.5	48	48	41	43	11	16	7.7	8.8
Specific Conductance	micromhos	439	8,910	7,360	7,760	10,900	9,980	2,920	6,610	6,660	5,100	5,000	1,960	1,950	1,540	1,770
pH	units	7.2	7.8	7.8	7.9	7.8	7.8	7.6	8.1	8.2	-	6.3	7.8	7.7	6.8	-
Temperature	°C	11.5	27.0	27.0	29.0	29.0	25.5	18.0	81.7	78.5	44.0	56.0	30.0	30.0	40.0	26.5
Arsenic	µg/l	0	28	5	6	8	30	2	2	3	0	0	-	7	0	-
Barium	µg/l	0	700	700	700	900	600	200	<100	200	0	0	-	100	0	-
Beryllium	µg/l	0	0	0	0	0	0	<10	10	10	0	0	-	<10	0	-
Boron	µg/l	30	1,100	650	650	730	880	210	40	40	340	320	-	210	140	-
Lithium	µg/l	20	970	900	940	1,100	1,300	260	1,800	1,800	1,600	1,700	-	640	680	-
Mercury	µg/l	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0	0.1	0.0	0.0	-	0.1	0.0	-
Selenium	µg/l	0	0	0	1	0	0	0	0	0	0	0	-	0	0	-
Strontium	µg/l	150	1,400	1,800	1,700	2,300	1,800	930	2,000	2,100	1,400	1,200	-	260	340	-

[1]Sampled 1 hour after pumping 10 gpm.
[2]Sampled 25 hours after pumping 10 gpm.
[3]Milligrams per litre.
[4]Micrograms per litre.
[5]To convert feet to meters, multiply by .3048.
[6]To convert gpm to l/s, multiply by .06309.

Analysis by Central Laboratory, Salt Lake City, Utah

Table 2
LABORATORY DETERMINATION OF POROSITY,
INTERMEDIATE-DEPTH CORE HOLE 3

(Analysis by Central Laboratory, Salt Lake City, Utah)

LAB SAMPLE NO.	DEPTH [1](FEET)	TOTAL POROSITY (PERCENT)	EFFECTIVE POROSITY (PERCENT)
75-IDA 73	1077.0-1078.0	34.1	30.3
74	1083.5-1084.5	53.4	46.6
75	1094.8-1095.5	41.3	21.2
76	1103±	25.3	23.0
77	1109.0-1110.0	26.5	23.6
78	1110.0-1110.6	29.5	27.0
79	1118.0-1119.0	32.1	31.5
80	1124.0-1125.5	42.1	39.7
81	1128.6-1130.0	39.8	38.1
108	1136.0-1136.8	32.3	32.1
82	1146.0-1147.0	44.2	43.2
83	1148.0-1148.6	37.0	32.8
84	1159.0-1160.5	32.5	28.9
85	1168.5-1170.0	55.0	48.1
86	1178.6-1180.0	44.4	41.1
87	1180.2-1180.7	44.1	41.3
88	1193.0-1193.8	40.2	38.4
89	1193.8-1195.0	49.6	47.0
90	1203.8-1204.5	41.2	38.4
91	1212.5-1214.0	47.4	42.7
92	1221.0-1222.0	38.8	34.3
93	1226.9-1227.5	40.5	37.1
94	1235.0-1235.5	51.0	48.2
95	1243.2-1244.0	40.6	36.3
96	1251.1-1253.0	41.0	35.1
97	1259.5-1261.0	36.0	32.8
98	1268.0-1269.3	26.8	24.6
99	1279.0-1280.0	32.2	28.6
100	1288.0-1289.2	31.7	27.2
101	1294.0-1295.0	33.3	29.1
102	1323.0-1324.0	34.4	28.5
103a	1327.0-1329.0	32.4	31.6
103b	1327.0-1329.0	41.6	37.5
104	1337.0-1337.8	35.7	27.9
106	1386.2-1387.0	26.2	24.2

[1]To convert feet to meters, multiply by .3048