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GEOTHERMAL RECONAISSANCE OF THE M. RICHART PROPERTY - CRANE CREEK AREA WASHINGTON COUNTY, IDAHO

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GEOTHERMAL RECONAISSANCE
OF THE M. RICHART PROPERTY - CRANE CREEK AREA
WASHINGTON COUNTY, IDAHO

Introduction

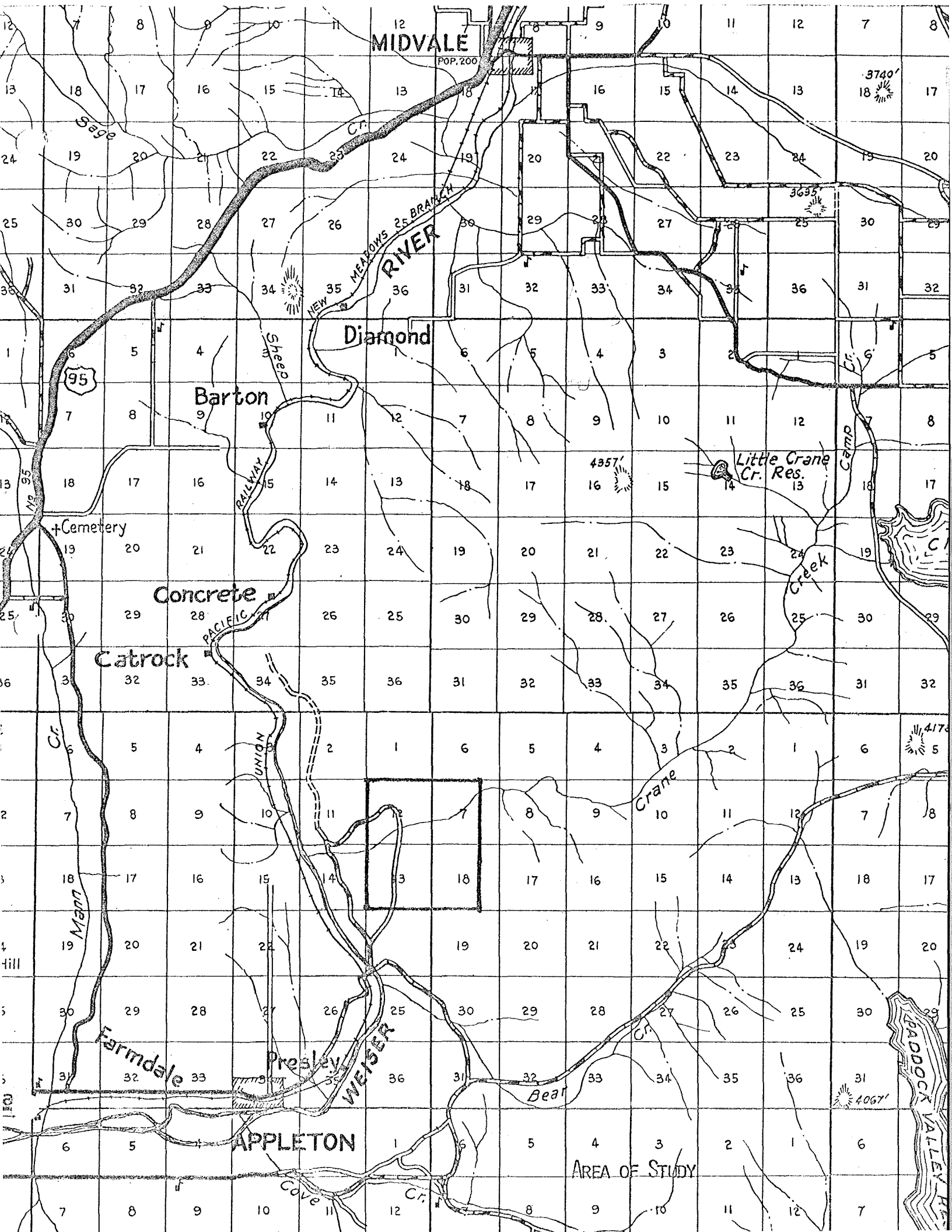
During November, 1974, this firm was retained to conduct a reconaissance geothermal study of the M. Richart property located on Crane Creek.

The study was to consist of field geologic exploration, water temperature and geochemistry and geological research. Field data were collected during the month of February and research data from November, 1974, to February, 1975. Sources of information include the U.S. Geological Survey, Idaho Department of Water Resources, U.S. Bureau of Reclamation, University of Idaho, Boise State University, and other private sources of data.

Geology

The property investigated lies within Township 11 North and Ranges 3 and 4 West. The area contains a semi-parallel series of anticlines and synclines which trend about North 35°- 45°West.

Consolidated formations exposed in the area are Tertiary in age; most are Miocene to Pleistocene with some overlying alluvium and colluvium of Holocene age. Units contained within the vicinity investigated include the Columbia River Basalt, the Payette Formation and portions of the Idaho Group.


MIDVALE
POP. 200
Sage Cr.
NEW MEADOWS BRANCH
RIVER
Diamond
Sheep
95
Barton
RAILWAY
Cemetery
Concrete
PACIFIC
Catrock
UNION
Cr.
Main
Farmdale
Presley
WEISER
APPLETON
Cove Cr.
Little Crane Cr. Res.
Camp
Creek
Crane
Bear Cr.
PADDOCK VALLEY
AREA OF STUDY
3740'
3695'
4357'
4167'
4067'

The Payette Formation and Idaho Group consist of a series of arkosic sandstones, poorly consolidated silt and claystones, and some shales. The rocks exposed on the Richart property consist primarily of the Columbia River Basalt and sandstones of the Payette Formation. The rocks of the Payette Formation have been infiltrated in the past by hydrothermal solutions, altering the primary cementation by depositing silica in the form of opal, and mercury in the form of cinnabar.

The Idaho Almaden Mines Company was at one time a leading producer of quicksilver (mercury) in the United States. This mine is located approximately 8 miles south-southeast from the Richart property. The hydrothermal solutions carrying the mercury probably rose along fault zones and apparently occurred in several pulses, the last of which occurred probably no later than the early Pleistocene (Anderson, 1941, p. 8). The heat source for these hydrothermal solutions can only be postulated, but they may have resulted from shallow magmatic intrusions rising along zones of tension fractures. The present hot springs in this area are probably the present day evidence for continuing activity.

Geophysics

Extensive geophysical data have been collected by the U. S. Geological Survey and others in the Weiser area. Only those data pertaining to the land investigated will be discussed here.

Gravity data were collected at a number of stations near the Crane Creek area. These data show an extensive gravity low in this vicinity. On the west of this low there lies a steep gravity gradient which suggests a high angle interface between rock units having widely seperated density values. Such an interface is commonly interpretated as a fault or fault

zone and could provide a conduit for the migration of water in a thermal system.

Audio Magnetotelluric surveys (AMT) were conducted in the vicinity of the Richart property. The soundings taken in this area indicate apparent resistivities of 10-20 ohm-metres at the surface, and an apparent resistivity of 1 ohm-metre at depth. Such apparent resistivity at depth could be an indicator of a number of geologic conditions. The anomaly could be (1) an extensive bed of bentonitic clay, (2) an area of mineralization, or (3) a zone of thermal mineralized water. Evidence from the geophysical data and elsewhere strongly suggest to the author that condition number (3) is the most likely.

Thermal Occurrences

The property investigated contained two groups of thermal springs. Generally, they occur in the NW/4, SE/4, NW/4, Section 7, Township 11 North, Range 3 West, and the NW/4, NW/4, SW/4, Section 7, Township 11 North, Range 3 West. These springs are essentially undeveloped and discharge directly to Crane Creek. They issue from silica cemented alluvium which overlies sandstones of the Payette Formation.

Siliceous sinter deposition is evident at most of the spring issuances. Sinter deposits are reliable indicators of subsurface temperatures in excess of 180° celsius (C).

The springs with the greatest discharge occur at the mouth of Crane Creek Canyon, and the westernmost springs issue from the trace of a prominent fault. This fault appears to be part of the fracture system upon which the Almaden mine is located. Based on the few drillers logs available, the thermal reservoir probably lies in the Columbia River Basalt or possibly

older rocks. Some reservoir potential also probably exists in the Payette Formation.

Water chemistry data collected by the author, State and Federal agencies, indicate the thermal water to be of a sodium choloride type. Total dissolved solids (TDS) range from 1070 - 1080 milligrams per litre (mg/l). Analyses of water from three spring issuances are shown in Table 1.

Subsurface temperatures were calculated using the silica geothermometer, the Na-K-Ca geothermometer and the mixed water method developed by the U.S. Geological Survey (Fournier and Truesdell, 1974) which takes into account the mixing of cold water with the thermal water upon ascension, (Table 2). The silica method indicated maximum subsurface temperatures of 173°C - 177°C. The Na-K-Ca method indicated temperatures of 163°C - 166°C which is excellent agreement with the silica method, and the mixed water model indicated maximum temperatures of from 235°C - 270°C. Because of the siliceous sinter deposition and the reliability of the mixed water model, it is estimated that thermal reservoir temperatures could very possibly reach the 235°C - 270°C predicted by the mixed water method. This temperature is one of the highest found in the state.

Other locations having similar high temperatures do not have the same excellent level of resolutions between the various methods of estimation and are, therefore, suspect.

Areal Extent of the Thermal System

One paramount question before development of any resource can proceed is the areal extent and probability of sustained yield. Because the area of investigation has not been drilled except for shallow domestic wells, one can only estimate the areal extent of the thermal resource from the meager data available.

Well or spring identification #				Date of Collection	Discharge cfs.	Silica	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Carbonate	Alkalinity	Sulfate	Chloride	Fluoride	Nitrate + Nitrate	Phosphorus	Dissolved solids calculated	Dissolved solids tons per acre-feet	Hardness as CaCO3	Hardness Non-carbonate	Percent Sodium	Sodium Absorption Ratio	Specific Conductance (Field)	Ph field)	Water temp. (°C	Chemical constituents in micrograms per litre			
																												Arsenic	Boron	Lithium	Mercury
11N	3W	NW¼ SE¼ NW47		7/8/2	.01	180	29	.5	280	18	201	0	165	250	200	3.2	.01	.19	1078	1.46	74	0	86	14	1630	7.8	198f 92	41	1000	60	.3
		NW¼ SE¼ NW47		7/8/2	.01	190	29	.6	280	19	202	0	166	250	200	3.2	.04	.03	1088	1.47	75	0	86	14	1570	8	135f 57	44	1000	63	.1
		NW¼ NW¼ SW4		7/10/1	.10	180	26	.3	290	18	197	0	162	290	200	3.8	.14	.03	1078	1.46	66	0	88	16	1500	7.1	172f 77	42	1000	60	0

TABLE 1

CHEMICAL CONSTITUENTS OF THE THERMAL SPRINGS

ON THE RICHART PROPERTY, WEISER, IDAHO

Well or spring identification #			Discharge cfs.	Water Temp at surface	Aquifer temperatures from Geochemical thermometers-°C			
					Silica	Mixed Water Method	Percent Cold Water	Na-K-Ca
11N	3W	NW SE NW 7	.01	92	173	235	67	163
		NW SE NW 7	.01	57	177	—	—	166
		NW NW SW 7	.10	77	173	270	76	163

TABLE 2

ESTIMATED THERMAL AQUIFER TEMPERATURES
ON THE
RICHART PROPERTY, WEISER, IDAHO

The water quality and level of constituents for the thermal waters along Crane Creek are quite similar in nature, which would indicate they are derived from the same aquifer. Additionally, water sampled from Cove Creek Hot Springs, some 9.5 miles southeast of the area of study, is quite similar in quality to the Crane Creek Springs and probably rises from the same thermal aquifer.

The opalization and hydrothermal alteration which has occurred in the Almaden mine area is another piece of information which would tend to reinforce the possibility of an extensive aquifer. The deposited minerals were emplaced by alkaline hydrothermal solutions. Temperatures required for transport and deposition of such minerals range from 100°C - 150°C. Because of the similarity of the mineralogy and water quality at the mine, and the area near Cove Creek and Crane Creek, it is suspected they are interconnected - which would indicate an extensive thermal aquifer.

Potential Heat Sources

The heat for thermal waters on the Richart property could be from several potential sources. The most probable is that there exists a shallow magmatic intrusion in the area. Evidence to support this conclusion is (1) the presence of a reported rhyolite dike up Crane Creek from the mouth of the canyon, (2) the extensive structural deformation that has occurred in the area, and (3) that the existing AMT sounding show a shallow resistivity anomaly beneath the area which could be a shallow magmatic intrusion. Also, data by Pakiser (1963) shows that a thinning of the earth's crust does occur in this area and enhances the possibility of an intrusive magmatic body.

Irrigation

The possibility of utilizing the thermal waters on the Richart

property for irrigation exists, but extreme care must be taken. Because of the high temperature involved, the water should be held in ponds and cooled to approximately 100°F if flood irrigation is used, and 150°F if sprinkled.

More importantly, the water must be mixed at least 5 parts to 1 with non-thermal water, and a 10 to 1 mix would be better. The Boron content of the thermal water ranges from 10 - 11 mg/l, and even the most Boron tolerant crops can only survive applications of water containing up to 3.75 mg/l Boron.

Conclusions

The geology and geochemistry of the property investigated lead this author to believe this area has one of the greatest potentials for geothermal development in the State of Idaho. Geophysical data show resistivity and gravity anomalies which are indicative of a shallow heat source. The thermal occurrences, geochemistry and geophysics, all indicate that the resource has a large areal extent--an important requirement for resource development. The aquifer temperatures indicated by the geochemical thermometers have closer agreement than any published in Idaho, and are in the range of economically developable with today's technology.

Sufficient data now exists to initiate a preliminary exploration drilling program on these properties. No additional reconaissance exploration is needed. A drilling program is now necessary to determine the extent of the resource, the aquifer characteristics and the reservoir temperature.