DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

DEEP DRILLING DATA, RAFT RIVER GEOTHERMAL AREA, IDAHO

OPEN-FILE REPORT
79-1365

RAFT RIVER GEOTHERMAL INJECTION WELL 7

T. 15 S., R. 26 E., sec 25 db Elev 4855'

By
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DISCUSSION

The southern Raft River Valley near Bridge, Idaho has long been known as a thermal area (Stearns and others, 1938). In 1971, an area southwest of Bridge was designated the Frazier Known Geothermal Resource Area (Frazier KGRA) by the U.S. Geological Survey (Godwin and others, 1971). A geochemical reconnaissance of thermal waters in Idaho by the U.S. Geological Survey (USGS) in 1972 (Young and Mitchell, 1973) indicated a reservoir temperature near 300°F (150°C) for the Raft River geothermal anomaly.

As a result of proposals by the Raft River Rural Electric Cooperative, the U.S. Energy Research and Development Administration (ERDA, now the U.S. Department of Energy, DOE) became interested in the Raft River Valley as a potential site for an experimental binary-fluid geothermal power plant. During the summer of 1973 the USGS, in cooperation with ERDA, began an integrated geological, geophysical, geochemical, and hydrological exploration program in southern Idaho. This program was designed to provide a scientific framework for the evaluation of a geothermal resource and to test the applicability of various geological, geophysical, geochemical, and hydrological techniques to the study of geothermal resources. Williams and others (1976) summarize the early results of this program.

In order to obtain the physical data necessary to evaluate these techniques, a drilling program was begun in the spring of 1974. Thirty-four auger holes were drilled to depths ranging from 25 ft (7 m) to 100 ft (30 m) (Crosthwaite, 1974), to measure the temperatures and flows of the near surface cold-water aquifers. In cooperation with the Idaho Department of Water Administration, the USGS also drilled 5 continuously cored wells to depths ranging from 250 ft (76 m) to 1,423 ft (434 m) (Crosthwaite, 1976) in order to test geophysical interpretations of the subsurface geology and to provide hydrological, geological, and geochemical data on the shallow part of the geothermal system.

During the early stages of the USGS-ERDA integrated geothermal exploration program three petroleum test boreholes were being drilled in the Raft River Valley by Standard American Oil Company. Shortly after completion of the petroleum test boreholes and just prior to deep geothermal drilling by ERDA, Standard American Oil Co. provided the USGS with cuttings and well logs from the test boreholes (Oriel and others, 1978). The information from these boreholes was used for initial interpretation of geophysical data and of the deep subsurface geology of the Raft River basin.

The first Raft River geothermal exploration borehole (RRGE #1), drilled in early 1975 (Reynolds Electrical and Engineering Co., Inc., 1975; Covington, 1977a), initially confirmed the existence of hot water (295°F; 146°C) in quantities (600 gal/min; 38 l/sec artesian flow) suitable for a medium-temperature experimental binary-fluid geothermal power plant. Drilling of RRGE #2 (Reynolds Electrical and Engineering Co., Inc., 1976; Covington, 1977b) and RRGE #3 (Covington, 1977c; Covington, 1977d; Reynolds Electrical and Engineering Co., Inc., 1977) followed in rapid succession with both producing more than 350 gal/min (22 l/sec) sustained artesian flow with temperatures above 295°F (146°C).

In early 1977, following a period of flow and injection testing, the fourth geothermal exploratory borehole (RRGE#4) was drilled (Covington, 1978). RRGE#4 was sited in order to test the effect of injection of geothermal fluids at intermediate depths (2,000–3,000 ft; 600–1,000 m) within the geothermal resource area.

It was determined that injection of the geothermal fluids should take place outside the main geothermal resource area; sites for Raft River geothermal injection boreholes (RRGI) six and seven were selected just south of the production area.

In April 1978, RRGI #6 was drilled to a depth of 3,872 ft (1,180 m) (Covington, 1979b; Miller and Prestwich, 1979a). During May and June 1978, Raft River Geothermal Production (RRGP) Well #5 was drilled just west of RRGE #1 (Covington, 1979a). RRGP #5 reached a total depth of 4,911 ft (1,497 m) with a maximum downhole temperature of 273°F (143°C).

Drilling of Raft River Geothermal Injection (RRGI) Well #7 by Colorado Well Service began on July 14, 1978 (Miller and Prestwich, 1979b). Drilling mud was used as the drilling fluid to a depth of 2,036 ft (620 m). Following a directional survey, 13 3/8 in. (34 cm) casing was installed to a depth of 2,028 ft (618 m). Drilling then continued using water as the drilling fluid. A core was taken from 3,812 ft (1,162 m) to 3,842 ft (1,171 m) where drilling was halted and borehole geophysical logging conducted.

DATA SUMMARY

Drilling period:		July 14	to	July 31, 1978
Total depth:		3,842 ft		1,171 m
Casing:		2,028 ft		618 m
Maximum Temperature:		149°F		65°C
Top of Salt Lake Formation:		1,184 ft		361 m

CORE

Core #1 3,812–3,842 ft (1,162–1,171 m) Salt Lake Formation: Siltstone and medium-grained sandstone, calcareous, and greenish gray in color, with bedding dips 5°–10°. The few fractures that can be seen are partly filled with calcite and dip 60°–90°.

GEOPHYSICAL LOGS

Log	Date	Logged Interval feet	meters
Temperature	7-31-78	2,050–3,800	625–1,158
Compensated Densilog/ Gamma	8-1-78	2,049–3,796	625–1,157
Compensated Neutron/ Gamma	8-1-78	2,050–3,789	625–1,155
BHC Acoustilog	7-31-78	2,050–3,793	625–1,156
Dual Induction-Focused Log	8-1-78	2,040–3,789	621–1,155

Borehole geophysical logging was carried out by Dresser Atlas Wireline Service. No adequate Caliper log was obtained for this borehole below casing. The Gamma log used in this report is from the Compensated Densilog run on August 1, 1978.

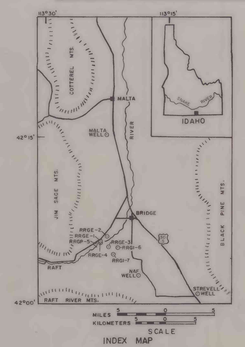
EXPLANATION

SALT LAKE FORMATION (TERTIARY): Gray to light-green, thin-bedded to massive, tuffaceous siltstones and sandstones with minor beds of conglomerate. In the western part of the Raft River Basin the formation is divided by a volcanic member at Jim Sage Mountain into upper and lower members (Williams and others, 1976)

Lithologic changes shown within the Salt Lake Formation are based solely on the well cuttings and may not correspond exactly to changes in the geophysical logs. Cuttings and core were examined and described in the office and lithologic breaks assigned without the use of geophysical logs. Sample depth control was maintained, through the use of a carbide lag, by Rocky Mountain Geo-Engineering.

REFERENCES

Covington, H. R., 1977a, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Exploration Well #1: U.S. Geological Survey Open-File Report 77-226.
_____1977b, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Exploration Well #2: U.S. Geological Survey Open-File Report 77-243.
_____1977c, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Exploration Well #3: U.S. Geological Survey Open-File Report 77-616.
_____1977d, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Exploration Well #3 Sidetrack-Ct: U.S. Geological Survey Open-File Report 77-803.
_____1978, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Exploration Well #4: U.S. Geological Survey Open-File Report 78-91.
_____1979a, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Production Well #5: U.S. Geological Survey Open-File Report 79-362.
_____1979b, Deep drilling data, Raft River geothermal area, Idaho, Raft River Geothermal Injection Well #6: U.S. Geological Survey Open-File Report 79-1129.
Crosthwaite, E. G., 1974, Preliminary data for thirty-four test wells augered in the Raft River Valley, February 13-March 8, 1974: U.S. Geological Survey Open-File Report, 17 p.
_____1976, Basic data from five core holes in the Raft River geothermal area, Cassia County, Idaho: U.S. Geological Survey Open-File Report 76-665, 12 p.
Godwin, L. H., Haigler, L. B., Rioux, R. L., White, D. E., Muffler, L. J. P., and Wayland, R. G., 1971, Classification of public lands valuable for geothermal steam and associated geothermal resources: U.S. Geological Survey Circular 647, 17 p.
Miller, L. G., and Prestwich, S. M., 1979a, Completion Report: Raft River Geothermal Injection Well #6: NTIS, IDO-10083, 12 p.
_____1979b, Completion Report: Raft River Geothermal Injection Well #7: NTIS, IDO-10084, 12 p.
Oriel, S. S., Williams, P. L., Covington, H. R., Keys, W. S., and Shaver, F. C., 1978, Deep drilling data, Raft River geothermal area, Idaho, Standard American Oil Co., Malta, Raf, and Strevell Petroleum Test boreholes: U.S. Geological Survey Open-File Report 78-361, 2 sheets.
Reynolds Electrical and Engineering Co., Inc., 1975, Completion Report, Raft River Geothermal Exploratory Hole #1: NTIS, IDO-10062, 41 p.
_____1976, Completion Report, Raft River Geothermal Exploratory Hole #2: NTIS, IDO-10066, 59 p.
_____1977, Completion Report, Raft River Geothermal Exploratory Hole #3: NTIS, IDO-10069, 47 p.
Stearns, H. T., Crandall, L., and Steward, W. G., 1938, Geology and ground-water resources of the Snake River Plain in southern Idaho: U.S. Geological Survey Water-Supply Paper 774.
Williams, P. L., Mabey, D. R., Zohdy, A. A. R., Ackerman, H., Hoover, D. B., Pierce, K. L., and Oriel, S. S., 1976, Geology and geophysics of the southern Raft River Valley geothermal area, Idaho, U.S.A.: Second United Nations Symposium on the development and use of geothermal resources, San Francisco, California, May 20-29, 1975, v. 2, p. 1273-1282.
Young, H. W., and Mitchell, J. C., 1973, Geothermal investigations in Idaho--Part 1.: Geochemistry and geologic setting of selected geothermal waters: Idaho Department of Water Administration Water Information Bulletin 30, 43 p.

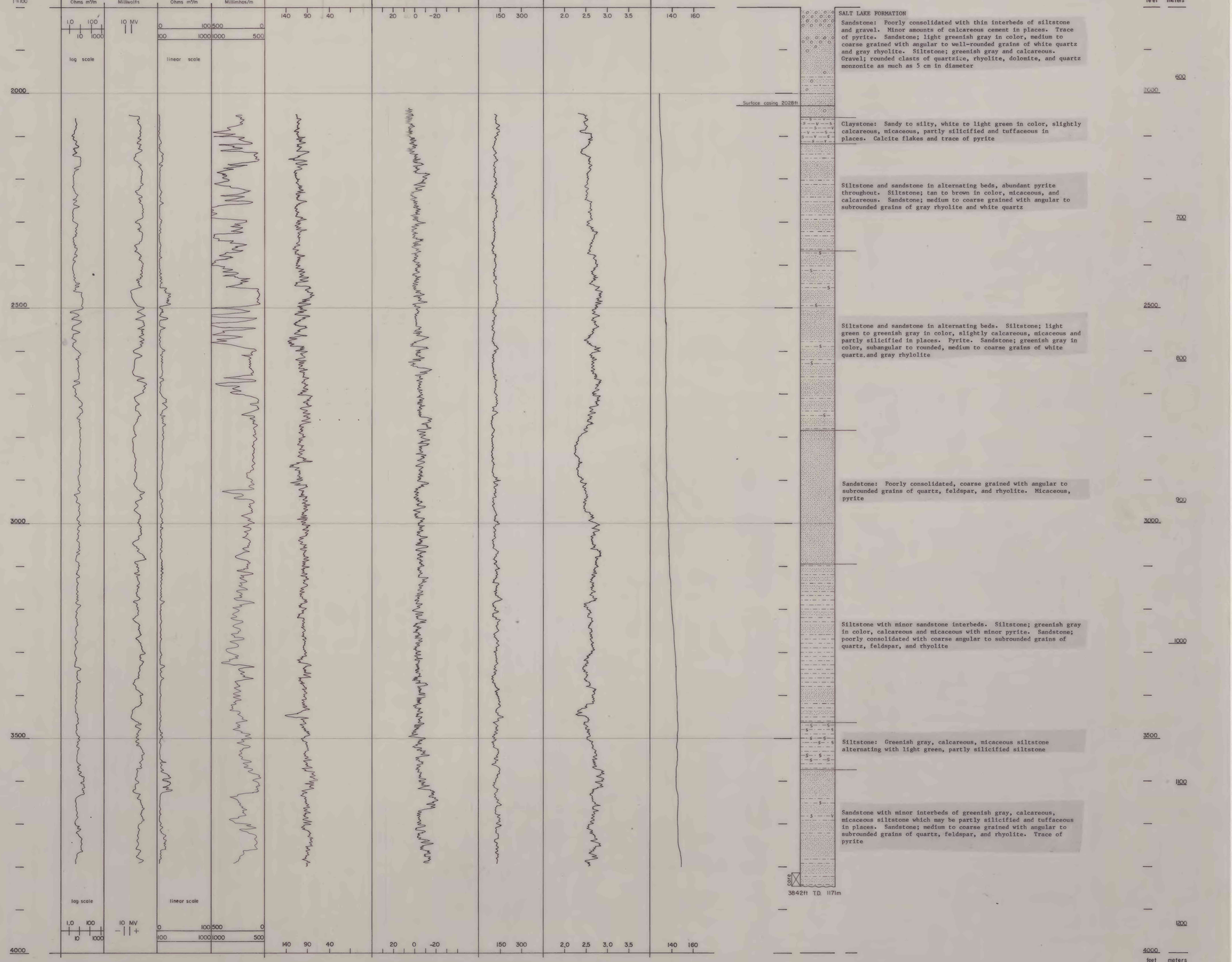


WELL-LOCATION SYSTEM

Idaho well numbers indicate the locations of wells within the official rectangular subdivisions of the public lands, with reference to the Boise base line and meridian. The first two segments of a number designate the Township and Range (T. 15 S., R. 26 E.). The third segment is the section number, followed by two letters which indicate the quarter-section, and the 40-acre tract (sec. 25db). Quarter sections are lettered a, b, c, and d in counterclockwise order from the northeast quarter. The 40-acre tracts are lettered in the same manner.

EXPLANATION

CLAY SILT SAND GRAVEL TUFF SILICIFIED



cm = in (2.54) m = ft (0.3048) km = mi (1.609) microseconds/m = microseconds/ft (0.3048) L/sec = gal/min (0.063) °C = 5/9 (°F - 32)