

## **NOTICE CONCERNING COPYRIGHT RESTRICTIONS**

This document may contain copyrighted materials. These materials have been made available for use in research, teaching, and private study, but may not be used for any commercial purpose. Users may not otherwise copy, reproduce, retransmit, distribute, publish, commercially exploit or otherwise transfer any material.

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted material.

Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specific conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

This institution reserves the right to refuse to accept a copying order if, in its judgment, fulfillment of the order would involve violation of copyright law.

# STATE OF ALASKA GEOTHERMAL RESOURCE ASSESSMENT AND RESERVOIR DEFINITION PROGRAM

R. B. Forbes

Geophysical Institute, University of Alaska

---

(January-December, 1979)

---

## Cooperating Agencies

The Alaska geothermal resource assessment and reservoir definition program is a cooperative effort which includes personnel and facilities from the Geophysical Institute, University of Alaska, the State of Alaska Division of Geological and Geophysical Survey (DGGs) and the Division of Energy and Power Development. The group also maintains a close liaison with the U.S. Geological Survey in the national assessment program, and recently collaborated with the U.S.G.S. on the Alaskan sections in Circular #790. We have also worked closely with the OIT Geo-Heat Utilization Center in the supply of data for tables and maps in the recently published "Geothermal Energy in Alaska: Site Data Base and Development Status" (Markle, 1979).

## Program Responsibilities and Projects

Under the provisions of Geophysical Institute resource assessment commitments to DOE, an Alaskan geothermal resources map is nearing completion which will include low temperature resource data on thermal springs and petroleum test and production wells, in addition to information on volcanic systems and heat flow measurements by the U.S. Geological Survey.

Work done during 1979 was focused on the location and characterization of geothermal reservoirs in Alaska, utilizing data acquired during the preceding (1978) resource assessment phase. The Geophysical Institute concentrated on the geophysical and geological evaluation of two hydrothermal systems (Pilgrim and Chena Hot Springs), and DGGs initiated an on-going program to produce a "Geologic Atlas of Hot Spring Areas of Alaska," and an in-house laboratory capability for the chemical analyses of geothermal and ground waters, and relevant rock and mineral samples. With the assistance of DOE funding, DGGs has also added two geologists and a laboratory technician to its staff, who will be assigned to geothermal projects. The expanded laboratory program is under the supervision of a new director of analytical services. Water samples collected during summer 1979 are being analyzed, and a new x-ray fluorescence analytical facility is scheduled for completion in spring or summer 1980. Additionally, DGGs geologists are working with Geophysical Institute geophysicists and geologists on site-specific geothermal reservoir studies, including the Pilgrim Springs investigation.

Donald L. Turner is the coordinator for geothermal research at the Geophysical Institute, and the Principal Investigator for the Geothermal Resource Assessment and Definition Program. Ross Schaff, Alaska State Geologist, directs DGGs geothermal activities, and is the Principal Investigator for the DGGs work phases of the program.

## The Pilgrim Springs Project

Reconnaissance geophysical studies (Forbes, et al., 1975) had indicated that the Pilgrim Springs hydrothermal system, which is located about 65 km north of Nome, deserved further work. Through the cooperation of the State of Alaska Division of Energy and Power Development, and the support of Nome area residents and legislators, the Alaska State Legislature appropriated state funds for a geothermal demonstration project at Pilgrim Springs, which included an increment to be used for geophysical and geological exploration prior to drilling. These funds were administered by the Division of Energy and Power Development, and paired with DOE funds under the reservoir definition program, to conduct a detailed geophysical and geological survey of the site. This is the first State of Alaska-DOE cooperative field geothermal study which has included legislatively appropriated funds: an important milestone in the program. The field work included seismic and resistivity surveys, shallow subsurface temperature measurements, hydrologic studies including water temperature and conductivity determinations, a shallow subsurface electrical conductivity survey, and bedrock and surficial geological mapping.

A preliminary report (Forbes, et al., 1979) outlining the results of this work, and recommended drilling sites was delivered to the State Division of Energy and Power Development in October 1979.

The report defined three subsurface thermal anomalies as potential drilling targets. The most promising of these is an east-northeasterly trending anomaly which is centered around a maximum subsurface temperature of 96°C, measured at a depth of 5.5 meters. The 80°C isotherm in this anomaly (at 4.5 meters) encloses an elliptically shaped area which is about 400 x 75 meters.

In November-December 1979, two shallow test holes were drilled at Pilgrim Springs under the aegis of the State Division of Energy and Power Development and well site geologists from DGGs, with exciting results. Although the test sites were deliberate step-outs away from the prime target recommended in the preliminary report, the test wells #1 and #2 produced approximately 200 and 400 gal/min of 90°C water from a zone in a conglomeratic aquifer at a depth of about 30 meters. The conglomerate contains silicic and pyritic cement, and the flow of water at the wellhead is accompanied by the discharge of hydrogen sulfide.

The drilling results and recent heat flow and hydrologic studies at the Geophysical Institute indicate that the Pilgrim Springs hydrothermal system is a very large hot water dominated system in the 300-500 megawatt range; a resource of great importance to local communities. Deep drilling (500-1000 ft.) of prime targets is planned for Spring 1980.

### Planned 1980 Program

Work scheduled for 1980 includes the following projects:

- (1) Deep drilling (500-1000 ft.) and follow-up geophysical and geochemical studies of Pilgrim Springs (State of Alaska and DOE funds.)

- (2) Initiation of an agricultural demonstration project at Pilgrim Springs, including hydroponic, greenhouse and heated ground experiments (State of Alaska funds).
- (3) An RB-57 remote sensing study of Pilgrim Springs and the adjacent area which will include SLAR, infra-red and high resolution photographic imagery (NASA funds).
- (4) Initiation of a new reservoir definition study on Unalaska Island in response to the hot water and power needs of a burgeoning seafood processing industry (State of Alaska and DOE funds).
- (5) Continuation of geophysical and geochemical reservoir definition studies at Chena Hot Springs (DOE funds).
- (6) On-going cataloguing and geochemistry of Alaska thermal springs (State of Alaska and DOE funds).
- (7) Final editing of Geothermal Resources Map of Alaska.

#### References

- Forbes, R.B., Gedney, L., Van Wormer, D., and Hook, J. (1975) A geophysical reconnaissance of Pilgrim Springs, Alaska; Technical report, Geophysical Institute, University of Alaska.
- Forbes, R., et al.<sup>1</sup> (1979) A geological and geophysical assessment of the geothermal potential of Pilgrim Springs, Alaska; R. B. Forbes and D. L. Turner, Editors; Geophysical Institute preliminary report submitted to State of Alaska Division of Energy and Power Development and the U.S. Department of Energy (October 1979).
- Markle, Donald (1979) Geothermal energy in Alaska: Site data base and development status; OIT Geo-Heat Utilization Center Report, prepared for DOE under Contract #DE-AC03-79SF1049.
- Wescott, Eugene, et al.<sup>2</sup> (1979) A geological and geophysical study of the Chena Hot Springs geothermal area, Alaska; Eugene Wescott and D. L. Turner, Editors; Geophysical Institute preliminary report submitted to U.S. Department of Energy (December 1979).

<sup>1</sup>Principal Investigator: R.B. Forbes  
 Co-Principal Investigators: G. Wescott, D.L. Turner, J. Kienle  
 Participating Scientists: T. Osterkamp, D.B. Hawkins, J.T. Kline, S. Swanson, R.D. Reger, W. Harrison  
 Research Assistants: J. Peace, A. Lockhart, R. Sydora, R. McFarlane, R. Gaffi, D. Maynard, J.T. Hanscom, M. Kane, C. Stephens

<sup>2</sup>Geophysics Project Leader: Eugene Wescott  
 Principal Geologist: Norma Biggar  
 Participating Scientists: Thomas Osterkamp, Robert Forbes, Andrew Lockhart, William Harrison, Juergen Kienle, Donald Turner  
 Research Assistants: Jerry Peace, Richard Gaffi, Diana Nelson, Richard Sydora, Camille Stephens