

GEOHERMAL ACTIVITY IN 1975

**UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.**

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Summary of Exploration

Geothermal investigations in Oregon by both industry and research groups increased in 1975 as compared to prior years (Figure 1). This increased activity by industry partly reflected the accelerated leasing of both Federal and State lands. In addition, a revised State geothermal law, which became effective on July 1, 1975, facilitated drilling activities. The expanded level of geothermal exploration was paralleled by an increase in research by government agencies and university groups due to the availability of Federal funds for geothermal studies.

Exploration by industry during 1975 involved the utilization of a variety of geological, geophysical, and geochemical tools. Geological studies included mapping and age-dating of young volcanic rocks. Geophysical work consisted mainly of a variety of electrical, magnetic, and gravity techniques. Electrical methods included various resistivity arrays such as roving dipole and dipole-dipole as well as telluric and magnetotelluric techniques. The electrical methods were used both to locate potential areas and to provide depth data over known geothermal resource areas (KGRAs). Geochemical analyses of hot spring waters were used to calculate estimated reservoir temperatures.

Shallow drilling programs, with holes 100 to 500 feet deep for temperature gradient measurements, were undertaken by exploration groups in several areas in northeastern, south-central, and southeastern Oregon. Three deep holes designed to locate and test potentially productive geothermal reservoirs have been drilled in Oregon. One hole was started in 1975. San Juan Oil Company began drilling late in the year near Adel in Lake County and reached its objective depth of 7,516 feet.

Several geothermal research projects were underway in Oregon during 1975 with the purpose of evaluating various exploration methods and assessing the geothermal resource potential of favorable areas. The U.S. Geological Survey continued studies relating to geothermal resources in several areas in Oregon. Geologic mapping and age dating by Norman S. MacLess and others continued in the Cascade Range and Newberry Volcano areas. Geophysical studies were carried out in various KGRAs in preparation for lease sales. An evaluation of heat flow and ground water in the Klamath Falls area was directed by E. A. Sammel and John H. Sass.

Four geothermal research projects were conducted by the Oregon Department of Geology and Mineral Industries. These included completion of

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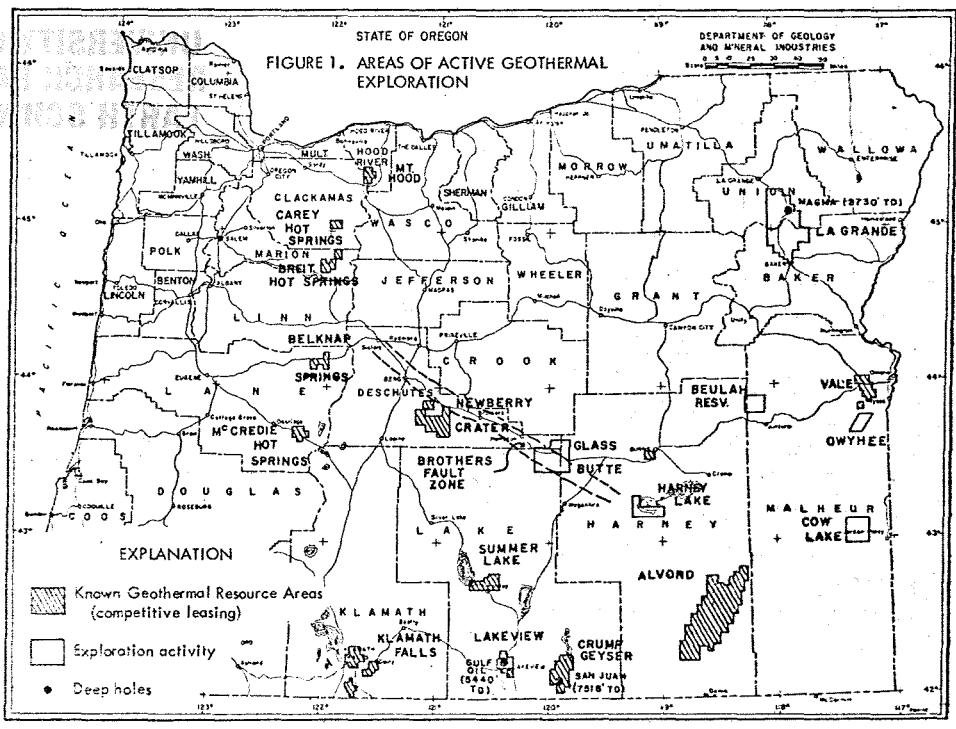


Table 1. Geothermal leases in Oregon in 1975

	Acres
Federal land ¹	
6 Noncompetitive	7,668
22 Competitive	98,117
Applications pending, December 31, 1975	900,000
Private land	
Estimated	240,000
State land ²	
Intercontinental Energy Co.	1,960
Max Millus	2,240
AMAX, Inc.	1,280
Chevron Oil	2,720

¹State office of U.S. Bureau of Land Management, Portland, Oregon

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a study of heat flow in the Vale area funded by the U.S. Bureau of Mines; initiating a heat-flow study along the Brothers Fault Zone in central Oregon with funds provided by the U.S. Geological Survey; and undertaking an electrical resistivity study utilizing dipole-dipole and Schlumberger techniques at Glass Buttes in northern Lake County jointly with E.R.D.A.'s Los Alamos Scientific Laboratory. A geological reconnaissance of hot-spring areas in the Western Cascade Range was begun by the Department as the initial phase of a heat-flow study to be continued in 1976.

Various university groups were active in geothermal research in 1975. Geothermal hydrology and geochemistry of the Klamath Falls area are being studied by John Lund at Oregon Institute of Technology. Detailed geophysical investigations in the Vale area in Malheur County were directed by

Table 2. Permits for deep geothermal wells in Oregon

Permit No.	Date issued	Company	Location	Status
1	Sept. 7, 1973	Gulf Mineral Resources	Lakeview NE $\frac{1}{4}$ sec. 17, 39 S., 20 E. Lake County	Hole drilled to 5,440' TD; abandoned Nov. 15, 1973
2	Sept. 7, 1973	Gulf Mineral Resources	Meadow Lake NE $\frac{1}{4}$ sec. 19, 38 S., 10 E. Klamath County	Permit issued and is still valid; no drilling done to date
3	July 25, 1974	Magma Energy	La Grande NW $\frac{1}{4}$ sec. 9, 4 S., 39 E. Union County	Hole drilled to 2,730' TD; abandoned Sept. 27, 1974
4	July 25, 1974	Magma Energy	La Grande NW $\frac{1}{4}$ sec. 9, 4 S., 39 E. Union County	Never drilled; permit cancelled
5	July 25, 1974	Magma Energy	Vale SE $\frac{1}{4}$ sec. 28, 18 S., 45 E. Malheur County	Never drilled; permit cancelled
6	July 25, 1974	Magma Energy	Vale NE $\frac{1}{4}$ sec. 28, 18 S., 45 E., Malheur County	Never drilled, permit cancelled
7	Oct. 27, 1975	San Juan Oil Company	NW $\frac{1}{4}$ sec. 22, 39 S., 24 E. Lake County	Hole drilled to 7,516' TD; abandoned Dec. 15, 1975
8	Oct. 28, 1975	Weyerhaeuser Pacific Power & Light Co.	NW $\frac{1}{4}$ sec. 15, 37 S., 7 E. Klamath County	Hole drilled to 250', 7" casing set at 250'; pro- jected depth 2,000'

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Table 3. Perm

Permit No.	Company
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2	Geothermal (Anadarko C
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8	Phillips Pe
9	Ore. Dept Mineral In
10	Ore. Dept Mineral In
11	Thermal Po
12	Phillips Pe
13	Union Oil
14	Al Aquita
15	Phillips Pe

* Prior to permit r

Bureau of Mines; in central Oregon undertaking an electric-logging techniques D.A.'s Los Alamos hot-spring areas in as the initial phase

al research in 1975. Falls area are being

Detailed geophysics were directed by

Richard Couch of Oregon State University. Some of the significant publications in 1975 resulting from geothermal research activities are listed at the end of this article.

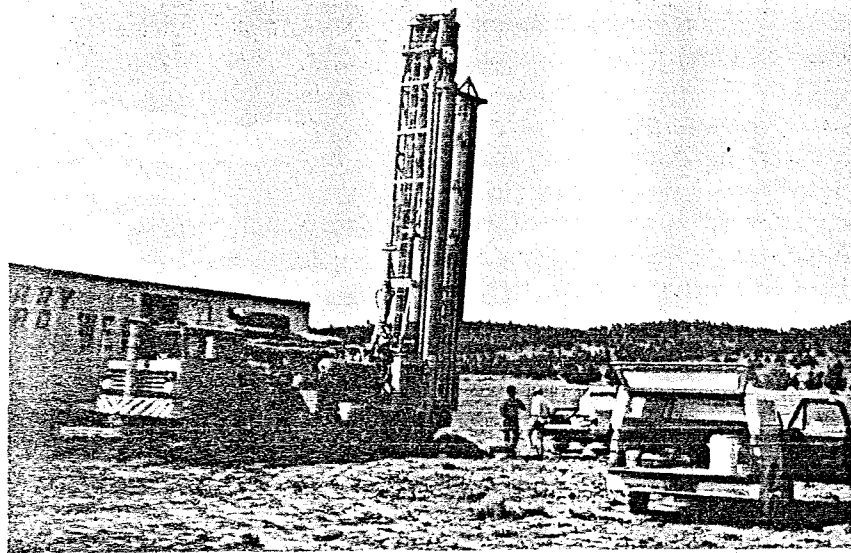
The geothermal industry faces an exciting but uncertain future. Research projects and initial exploration by industry have outlined a number of promising areas as yet untested by deep drilling. Development of Oregon's geothermal potential will progress slowly, however, due to the twin constraints of environmental regulation and a lack of financial incentives. There is significant overlap of regulations at various levels of government along with

Table 3. Permits for shallow prospect wells in Oregon

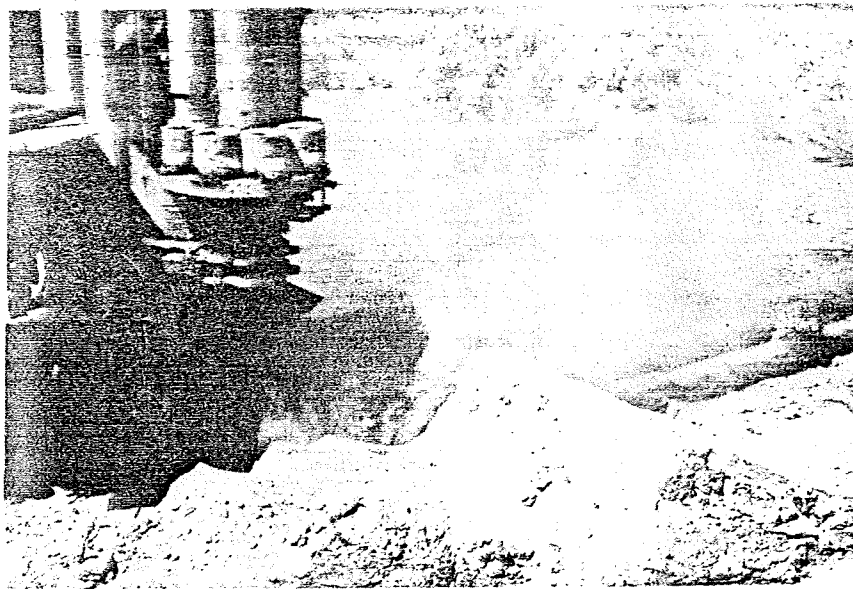
Permit No.	Company	Location	Date Issued
*	Thermal Power Co.	Klamath Falls Klamath County	November 1972
*	U.S. Geological Survey	Blue Mountain Malheur County	May 1974
*	Ore. Dept. of Geol. and Mineral Industries	Malheur County	U.S. Bur. of Mines research project
*	U.S. Geological Survey	Klamath Falls Klamath County	August 24, 1974
*	Union Oil Co.	Vale area, Malheur County	November 1974
1	Gulf Research & Development Co.	Warner Valley Lake County	July 24, 1974
2	Geothermal Surveys (Anadarko Oil Co.)	Alvord Desert Harney County	January 16, 1975
3	AMAX Exploration Co., Inc.	La Grande Union County	February 10, 1975
4	AMAX Exploration Co., Inc.	Vale, Malheur County	February 18, 1975
5	AMAX Exploration Co., Inc.	Beulah Reservoir Malheur County	February 26, 1975
6	AMAX Exploration Co., Inc.	Burns, Malheur County	March 14, 1975
7	AMAX Exploration Co., Inc.	Paisley, Lake County	March 10, 1975
8	Phillips Petroleum	Alvord Desert Harney County	March 10, 1975
9	Ore. Dept. of Geol. and Mineral Industries	Vale, Malheur County	April 9, 1975
10	Ore. Dept. of Geol. and Mineral Industries	Burns, Harney County	July 21, 1975
11	Thermal Power Co.	Klamath Hills Klamath County	August 8, 1975
12	Phillips Petroleum	Newberry Crater Deschutes County	August 14, 1975
13	Union Oil Co.	Alvord Desert Harney County	September 23, 1975
14	Al Aquitaine	Alvord Desert Harney County	November 5, 1975
15	Phillips Petroleum	Glass Butte Lake County	December 12, 1975

* Prior to permit number assignment

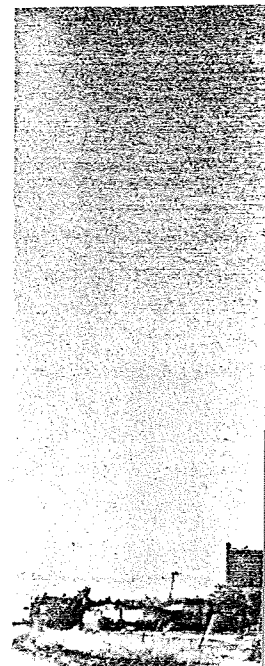
Status
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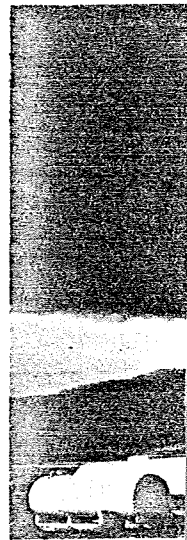
Department's geothermal-gradient test hole being drilled with a rotary air rig near the Brothers Fault Zone 17 miles west of Burns.



Close-up of air drill showing the automatic pipe-handling rack. Rubber skirts catch and hold cuttings around bore hole.



Abandonment cement well drilled near Hot Lake.

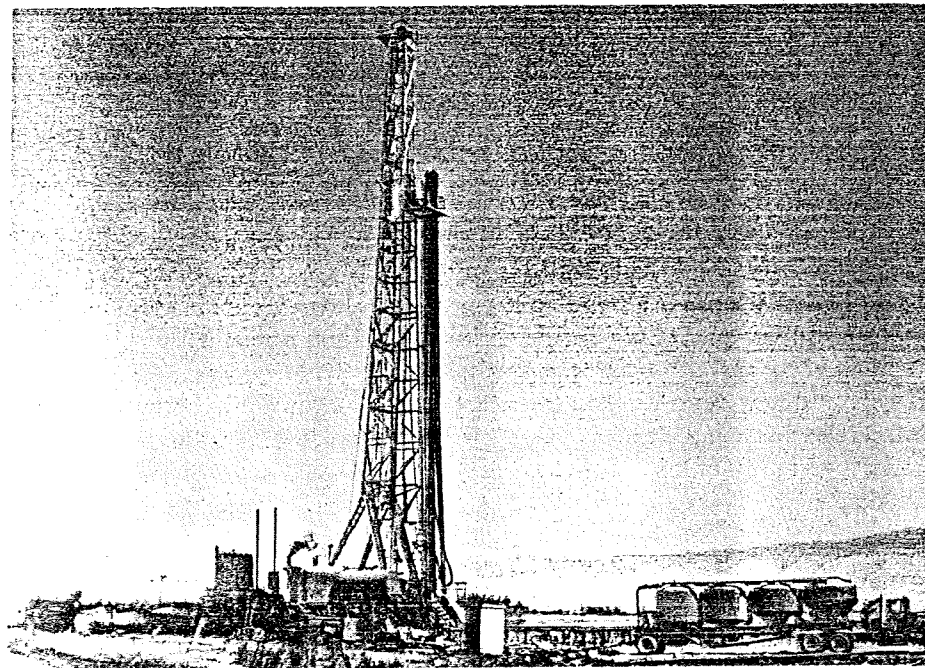


San Juan Co. well, 7,516 feet deep.

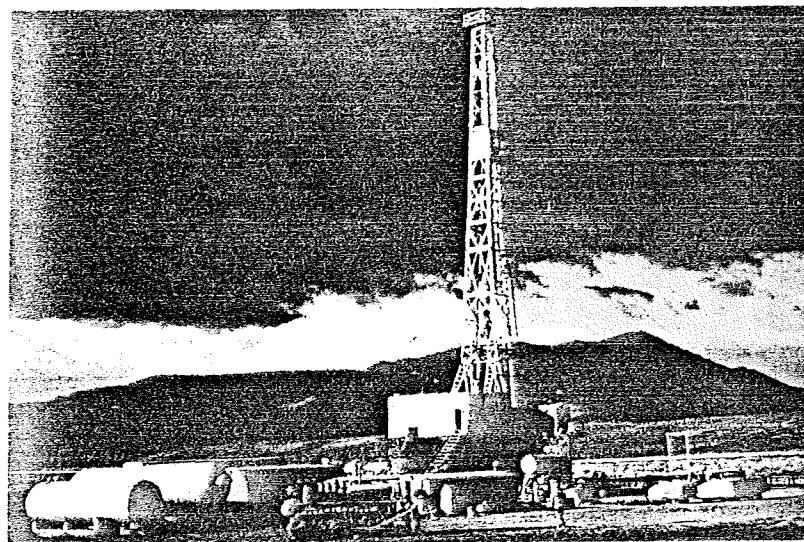


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Abandonment cementing operations at the Magma Energy steam-test hole drilled near Hot Lake, Union County, in October 1974.



San Juan Co. "Wolfson Ranch No. 1" steam-test hole drilled to 7,516 feet near Adel in Warner Valley December 1975.

leasing procedures which are cumbersome and expensive. It is not yet certain whether the increasing level of geothermal exploration will be maintained in the years ahead without viable financial incentives and a revision of geothermal leasing policies.

Leasing and Drilling Data

An estimated 370,000 acres of geothermal leases were active in Oregon at the close of 1975 (Table 1), and an additional 900,000 acres applied for on Federal lands are pending environmental assessment. More than 30 exploration companies are involved in the Oregon activity.

During 1975, the Oregon Department of Geology and Mineral Industries issued two deep-drilling permits and 14 shallow-hole permits for geothermal exploration; Tables 2 and 3 list all permits issued thus far by the Department. The U.S. Bureau of Land Management granted permits to three companies to conduct geophysical studies on Federal lands for geothermal assessment (Table 4).

The U.S. Bureau of Land Management held five competitive geothermal lease sales in 1975 (Table 5). Competition was not as great as expected; however, there was a considerable time lag between the date of application and the lease sales. In addition, inflation, excessive regulation, and shrinking exploration capital all undoubtedly had a depressing influence on the bidding. Additions were made in 1975 to the Vale, Crump Geyser, Summer Lake, Klamath Falls, and Breitenbush KGRAs because of overlapping filings. If areas applied for overlap by 50 percent or more, they must be leased by competitive bidding. Future lease sales are scheduled for the Klamath Falls KGRA in May 1976 and for the Summer Lake KGRA in July 1976.

Table 4. Permits for geophysical exploration on Federal lands in Oregon

Company	Location	Date issued
Chevron Oil Co.	Lakeview Basin Lake County	April 1975 Geophysical Surveys
Hunt Oil Co.	Klamath Falls Klamath County	August 1975 Geophysical Surveys
Southern Union Production Co.	Alvord Valley Harney County	October 1975 Geophysical Surveys
Southern Union Production Co.	Warner Valley Lake County	October 1975 Geophysical Surveys
Southern Union Production Co.	Klamath Falls Klamath County	November 1975 Geophysical Surveys

Table 5. F

KGRA

1. Vale Hot Spring
2. Alvord (Mickey H.S.)
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5. Alvord (Borax Lake)
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7. Alvord (Borax Lake)
8. Crump Geyser
9. Vale Hot Spring
10. Vale Hot Spring

¹State office, U.S. Bureau of Land Management

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 In the Summer Lake,
 Crump Geyser, and
 Vale Hot Spring areas. If
 these tracts must be leased by
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 area by July 1976.

lands in Oregon

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Table 5. Federal geothermal lease sales in Oregon¹

KGRA	Date	Company	No. of tracts	Acreage	Average bid per acre
1. Vale Hot Spring	June 27, 1974	Republic Geothermal	1	1,347	\$10.26
2. Alvord (Mickey H.S.)	May 22, 1975	Al Aquitaine	3	7,520	5.88
3. Alvord (Alvord H.S.)	May 29, 1975	Republic Geothermal	5	15,000	4.44
4. Alvord (Alvord H.S.)	May 29, 1975	Chevron Oil	1	2,560	17.90
5. Alvord (Borax Lake)	June 5, 1975	Mapco, Inc.	3	6,333	4.50
6. Alvord (Borax Lake)	June 5, 1975	Getty Oil Co.	1	2,126	5.25
7. Alvord (Borax Lake)	June 5, 1975	So. Union Prod. Co.	1	2,560	2.53
8. Crump Geyser	July 31, 1975	Chevron Oil	4	9,462	3.19
9. Vale Hot Spring	Sept. 25, 1975	Union Oil	2	4,486	16.16
10. Vale Hot Spring	Sept. 25, 1975	Geothermal Resource	1	2,560	3.00

¹State office, U.S. Bureau of Land Management, Portland, Oregon

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