A publication of the State of California - Division of Oil and Gas

Volume 3, Number 4 *July 1973*

"A little learning is a dangerous thing. Drink deep or taste not the Pierian Spring."

--Alexander Pope

GEOTHERMAL UNIT GOES METRIC

The Geothermal Unit of the California Division of Oil and Gas began, July 1st, to convert all operations to the metric system of measurement. Except for the retention of the section-township-range land survey system, the metric system will be used for all notices, well records, and publications (commencing with this issue of the Hot Line). Enclosed is a set of the conversion factors which will be used by the Geothermal Unit.

Note: Surface locations will be given in meters with feet following in parenthesis because most map scales are in feet and ready conversion scales to metric are not yet available.

API NUMBERS FOR ALL CALIFORNIA GEOTHERMAL WELLS

The Division of Oil and Gas is assigning unique API numbers to all geothermal wells drilled in California. Each number includes a 3-digit county code, plus a 5-digit number from the API number series. The series numbers for each county will range from 90001 to 95001. For example, the first well drilled in Lassen County will have the API number 035-90001.

These numbers will be recorded by the API, but at this ne will not be made a part of the API digital file. Instead, the numbers will be maintained in hard copy and will be made available to those interested, upon request, through the API in Washington, D.C.

• • COMING MEETINGS • •

UCLA METRIC CONFERENCE - EXHIBIT

"Going Metric: Meeting the Conversion Challenge" is the theme of a conference scheduled for September 7 & 8 on the UCLA campus in Los Angeles. The purpose of the conference is to make the general public aware of the accelerating trend toward total conversion to the metric system and to aid industry in its effort to convert.

The program will include nationally known speakers and numerous exhibits and will stress the advantages of going metric.

Those interested should contact UCLA Metric Conference Director:

Valerie Antoine
10245 Andasol Avenue
Northridge, California 91324
Phone: (213) 781-8211 Ext. 2460

SYMPOSIUM - UNDERGROUND WASTE MANAGEMENT

A symposium on Underground Waste Management and Artificial Recharge; sponsored jointly by the American Association of Petroleum Geologists, the U.S. Geological Survey, and the International Association of Hydrological Sciences; will be held at the Fairmont-Roosevelt Hotel in New Orleans, Louisiana, September 25 through 29, 1973. Registration opens on Tuesday, September 25, 1973 and continues until 6 p.m. on the 26th.

Those attending this international symposium will be exposed to the latest thinking of government, industry, and academia, both foreign and domestic, on the state of the arts of injecting wastes underground and of artificially recharging subsurface reservoirs. Both subjects have definite geothermal applications.

American Geophysical Union Convention

The American Geophysical Union has issued a call for papers on geothermal research to be presented during the winter convention at the Jack Tarr Hotel in San Francisco, December 10 - 14, 1973. Included in the program are two sessions on geothermal resources.

The deadline for receipt of abstracts, which must be submitted on a special form supplied by the AGU, is September 21, 1973. The metric system must be used exclusively.

The name chosen for the geothermal sessions is: "Geophysical, Geochemical, Hydrologic, and Geologic Investigations of Geothermal Systems" and all papers submitted should adhere to this theme.

Send inquiries to:

American Geophysical Union
1707 L Street NW
Washington, D.C. 20036

Utah Geological Association

The annual field trip of the Utah Geological Association, to be held September 21 & 22, will cover the geothermal and mining areas of the Milford region in Beaver County, Utah. For more information contact:

James A. Whelan
Dept. of Geology
University of Utah
Salt Lake City, Utah 84112

IMPERIAL VALLEY MESA ANOMALY MICRO SEISMIC STUDY

The Bureau of Reclamation and the University of California are completing a micro seismic study of the Mesa anomaly. Preliminary results indicate considerable seismic activity related to the anomaly. Data from this study should be available by the end of 1973. Watch the Hot Line for the announcement.

MESA ANOMALY GEOPHYSICAL STUDY

A comprehensive analysis and comparison of geophysical techniques applied on the Mesa anomaly relating to geothermal exploration is being compiled by Chandler Swanberg of the Bureau of Reclamation. The findings will be published possibly by late September in a new journal, *Energy Sources,* published by Crane, Russak and Co. Inc. of New York. Watch the Hot Line for the announcement.

POST-MIOCENE VOLCANOES

The International Association of Volcanology is preparing a map of the post-Miocene volcanoes of the world. Publication of data-sheets with index maps will be started soon. For further information contact:

Prof. P. Evrard
Laboratoires de Geophysique
45, avenue des Tilleuls
4000 Liege, Belgium

5TH INTERNATIONAL POST-GRADUATE COURSE IN GEOTHERMICS

The International Institute for Geothermal Resear of Pisa has again organized an International Post-Graduate Course in Geothermics, under the auspices of the National Research Council of Italy, the Italian Ministry for Foreign Affairs, and UNESCO.

The course will commence in Pisa, Italy on January 15, 1974 and continue for 9 months through October 15, 1974 with a break period in August. Following is a list of subjects which will be covered during the course:

1. Heat and thermodynamics.
2. General geothermics.
3. Volcanology.
4. Hydrology and geohydrology.
5. Hydrothermal systems.
6. Isotopic geology applied to geothermal research.
7. Reservoir engineering.
8. Geophysical prospecting methods.
9. Remote sensing and geological photointerpretation.
10. Analogical and mathematical models.
11. Drilling technology.
12. Utilization of low and high enthalpy fluids.
13. Monitoring of producing fields.

All lectures and seminars will be given in English. At present the expected number of course participants is 12 - there will be 8 scholarships available.

Any geologist, physicist, chemist, or engineer wishir to attend this course should contact the International Institute for Geothermal Research as soon as possible - applications will not be accepted after August 31, 1973. Send all inquiries to:

Instituto Internazionale per le Ricerche Geotermiche
Lungarno A. Pacinotti, 55
56100 Pisa, Italy

SURVEY NET - THE GEYSERS AREA

The National Geodetic Survey (NGS) has just completed a 72 km (45 mi) first-order survey for leveling control from Lower Lake in Lake County westerly, along Hwy 29, to its intersection with Hwy 175; thence southeasterly, along Hwy 175, to its intersection with Socrates Mine Road; thence westerly to the Lake-Sonoma County line; thence northwesterly, along the county line (ridgeline of the Mayacmas Mountains) to a point north of The Geysers Geothermal Field; thence southerly, through the field, to Big Sulphur Creek; thence southeasterly, along Big Sulphur Creek, to a tie-in point near the southwest corner of Sec. 33, T. 11 N., R. 8 W., M.D.B. & M. Bench marks were set at each power plant cooling tower in The Geysers Field.

The portion of this line from Lower Lake to the Socrates Mine is a re-survey of an old second-order surve

Unadjusted field data and descriptions of new bench marks are available from the U.S.G.S. at 2800 Cottage Way, Sacramento, California 95825.

RECENT GEOTHERMAL LEGISLATION IN CALIFORNIA

Three bills have been introduced by Senator Dills, et al. Their content and present status is as follows:

S. B. 563 (March 28, 1973)
This bill would exempt the value of geothermal resources from the assessment of land at full cash value, for purposes of property taxation. It directs the assessor in his assessment of property not to consider or include the value of developed or proven, but unused, reserves of geothermal resources. If passed operators would not be taxed on geothermal resources which they cannot sell for lack of an outlet; for example, during that period from the discovery of geothermal resources until a power plant is constructed.
Status - The bill was heared in committee on June 6, 1973.

S. B. 564 (Coauthored by Assemblyman Seeley, March 28, 1973)
This bill would have included geothermal resources used in the generation of electric power within the depletion allowance authorized for oil and gas wells under the Personal Income Tax Law and Bank and Corporation Tax Law. At present a depletion allowance of 22 percent is in effect only at The Geysers field in Sonoma County. If passed the bill would have extended the coverage state wide.
Status - The bill has been dropped.

S. B. 577 (March 28, 1973
This bill would have directed the Public Utilities Commission to establish a schedule of rapid amortization of the cost of public utility facilities utilizing geothermal resources, based upon their estimated useful life, and that this provision would have remained in effect until January 1, 1984. If it had been passed the bill would have allowed public utilities to amortize the cost of power plants within their useful lives making capital available sooner for the construction of new plants.
Status - The bill has been dropped.

One bill was introduced by Senator Roberti, its content and status are as follows:

S. B. 761 (April 12, 1973)
This bill appropriates an unspecified amount of money to the Department of Conservation for research into the development of geothermal energy.
Status - The bill is pending a hearing in the Natural Resources and Wildlife Committee.

Two spot bills were introduced: One by Assemblyman McAlister and one by Assemblyman Brown.

A. B. 1738 (McAlister, April 1973)
A. B. 2335 (Brown, May 8, 1973)

Both bills have altered punctuation in a section of the *California Laws for Conservation of Geothermal Energy.* This action allowed the authors to introduce legislation before the dead line and complete the bills at their leisure. Their intentions are unknown.
Status - Both bills are pending, and no action has been taken to date.

POWERPLANTS AT THE GEYSERS

Following is an up-date on the status of the powerplants at The Geysers Geothermal Field in Lake and Sonoma Counties, California:

Units 1 through 8	Installed capacity 305 mw.
Unit 9	Scheduled completion, September 1, 1973.
Unit 10	Scheduled completion, November 1, 1973.
Unit 11	Now pouring concrete for turbine foundation. Scheduled completion, Fall 1974.
Unit 12	Site approval awaiting Public Utilities Commission decision.
Unit 13	P. G. & E. and Signal have not yet agreed on site location.
Unit 14	Site approval awaiting PUC decision.
Unit 15	P. G. & E. and Pacific Energy Corporation nearing agreement on site location.

• • PUBLICATIONS • •

TOTAL FLOW CONCEPT - GEOTHERMAL BRINE

A paper on "The Total Flow Concept for Recovery of Energy from Geothermal Hot Brine Deposits" by Austin, Higgins, and Howard is available from the Lawrence Laboratory, University of California, Livermore.

The paper suggests that a radial and tangential flow impulse device is preferable to reaction turbines in utilizing Salton Sea type geothermal brines for commercial power generation.

GEOTHERMAL EXPLORATION REPORT

"The Search for Hot Rocks, Geothermal Exploration, Northwest", an article written by J. Eric Schuster with the Washington Division of Mines and Geology, has recently been published.

The report (Reprint 11) lists the requirements that are necessary for a geothermal reservoir to exist and discusses the two general types of reservoirs, dry steam and hot water. Diagrams include a pictorial view of a typical geothermal reservoir, showing the heat source, permeable rocks, fluid, a cap rock; and a dry steam plant and a hot water plant.

Reprint 11 may be obtained, without charge, from the Dept. of Natural Resources, Division of Mines and Geology, 1404 Jefferson Street, Olympia, Washington, 98504.

U.S.G.S. OPEN FILE REPORTS

The U.S. Geological Survey released the following reports on open file. Copies are available for inspection in the U.S.G.S. libraries at 1033 GSA Bldg., Washington, D.C. 20244; Bldg. 25, Federal Center, Denver, Colorado 80225; 345 Middlefield Road, Menlo Park, California 94025; and in other offices as listed:

1. Geologic Map of Thoreau Quad., McKinley County, New Mexico, by Jacques F. Robertson. 20 pages, 1 map (1:24,000), 1 sheet cross-section. Copy available at 1012 Federal Bldg., Denver, Colorado 80202; 8102 Federal Office Bldg., Salt Lake City, Utah, 84111; 1100 Commerce Street, Room 1-C-45, Dallas, Texas 75202; 223 Geology Bldg., University of New Mexico, Albuquerque, New Mexico 87106; New Mexico State Bureau of Mines and Mineral Resources, Socorro, New Mexico 87801; and U.S. Atomic Energy Commission, Grants, New Mexico 87020. Released June 26, 1973.

2. Bouguer Gravity Map of Parts of Esmeralda and Mineral Counties, Nevada, and Inyo and Mono Counties, California, by Donald L. Peterson. 1 sheet (1:250,000). Copy available 1012 Federal Bldg., Denver, Colorado 80202; 8102 Federal Office Bldg., Salt Lake City, Utah 84111; 504 Custom House, San Francisco, California 94111; 7638 Federal Bldg., Los Angeles, California 90012; Mackay School of Mines, University of Nevada, Reno, Nevada 89507.

3. Distribution and Chemical Analyses of Thermal Springs in Alaska, compiled by Thomas P. Miller. 5 pages, 1 plate. Brooks Bldg., College, Alaska 99701; 441 Federal Bldg., Juneau, Alaska 99801; 108 Skyline Bldg., 508 2nd Avenue, Anchorage, Alaska 99701; 678 U.S. Courthouse Bldg., Spokane, Washington 99201; 504 Custom House, San Francisco, California 94111; 7638 Federal Bldg., Los Angeles, California 90012; 1012 Federal Bldg., Denver, Colorado 80202; and in the Alaska Division of Geological and Geophysical Surveys, 509 Goldstein Bldg., Juneau, Alaska 99801; 323 E. 4th Avenue, Anchorage, Alaska 99504; and University Avenue, College, Alaska 99701. Material from which copies can be made at private expense is available in the Alaskan Geology Branch, U.S.G.S., 345 Middlefield Road, Menlo Park, California 94025.

GEOTHERMAL POWER GENERATION - BINARY CYCLES

An article on "Advanced Binary Cycles for Geothermal Power Generation" by Bolt, Huchinson, and Cortez is available from The Ben Bolt Company, Consulting Engineers, 201 S. Lake Avenue, Pasadena, California 91101.

The paper covers a process, possibly freon based, which produces net power from 17.4% to 36.4% greater than the isobutane cycle, i.e., from 5,400 kw at 180° C to 16,000 kw at 315°C F vs 4,600 kw and 11,800 for isobutane.

OPEN FILE REPORT - WASHINGTON STATE

"Preliminary Geologic Map of the Southern Cascade Range - Washington", a report prepared by Dr. Paul E Hammond of Portland State University, was recently placed on open file by the Washington State Division of Mines and Geology.

Dr. Hammond is well acquainted with the geology of the area, having worked in the central and southern Cascades since 1957. The mapping and compilation were done with special emphasis on young volcanic rocks, volcanic centers, and geologic structures.

This report consists of a geologic map with cross-sections (scale = 1:500,000) that covers an area from Stevens Pass south to Vancouver and from Puget Sound east to Yakima; a detailed geologic map of the area between Mt. Adams and Mt. St. Helens; a chart showing the chronologic relationships of volcanic eruptions; and a brief explanation.

Interested persons may inspect this report at the Washington Division of Mines and Geology, 1404 Jefferson Street, Olympia, Washington 98504; the Oregon Dept. of Geology and Mineral Industries, 1069 State Office Bldg., Portland, Oregon 97201; and at the California Division of Oil and Gas, 1416 Ninth Street, Sacramento, California 95814.

Persons wishing to have copies made at their own expense may do so by contacting Ivor McCray's Copy Center, 121 W. Legion Way, Olympia, Washington 98501.

STANDARDIZED WATER ANALYSES

The Federal Interagency Work Group on Designation of Standards for Water Data Acquisition has prepared a report - "Recommended Methods for Water Data Acquisition".

This group is urging all organizations to use their standard methods for water analyses in order to develop a common data base. It is expected that the suggested techniques for collecting, analyzing, interpreting, and reporting water data will be up-dated as methods and requirements change with time.

For a free copy of this report contact:

R. H. Langford
Chief, Office of Water Data Coordination
U.S. Geological Survey, Room 102
2100 M Street, NW
Washington, D.C. 20244

• • WELL OPERATIONS • •

STATE OF ARIZONA

Geothermal Kinetics Systems Corporation

In late June Geothermal Kinetics completed drilling operations at their second geothermal well, "Power Ranches" 2, near Higley, Arizona (see Hot Line v. 3, nos. 1 & 3). The total depth of the new hole, 2788 m., is slightly less than the first well, which is about 1300 m. (3/4 mi.) east of this location.

State of California
Division of Oil and Gas
Geothermal Unit

CONVERSION FACTORS

from

Handbook of Chemistry & Physics, 1972

Distance

	cm.	in.	ft.	m.	mi.
1 centimeter	1	.39370079	.032808399	.01	6.2137119×10^{-6}
1 inch	2.54	1	.083333	.0254	1.57828×10^{-5}
1 foot	30.48	12	1	.3048006	1.89393×10^{-4}
1 meter	100	39.370079	3.2808399	1	6.2137119×10^{-4}
1 mile	160934.4	63360	5280	1609.344	1

Pressure

	lb/in²	kg/cm²	bar	atm.
1 pound/inch²	1	.070306958	.0689476	.0680460
1 kilogram/centimeter²	14.223343	1	.980665	.967841
1 bar	14.5038	1.019716	1	.986923
1 atmosphere	14.6960	1.03323	1.01325	1

Energy

	joule	cal.	BTU	watt hr.
1 joule (abs.)	1	.239006	9.48451×10^{-4}	2.777778×10^{-4}
1 calorie (NBS)	4.18400	1	3.9683207×10^{-3}	1.162222×10^{-3}
1 British thermal unit	1054.35	251.99576	1	.292875
1 watt hour	3600	860.421	3.41443	1

Enthalpy

	joule/g.	BTU/lb.	cal/g.
1 joule/gram	1	.430211	.239006
1 British thermal unit/pound	2.32444	1	.555556
1 calorie/gram	4.18400	1.8	1

Volume

	l.	gal.	ft³	bbl.	m³	acre ft.
1 liter	1	2641794	.03531566	6.289987×10^{-3}	1.000028×10^{-3}	8.1073609×10^{-7}
1 gallon	3.785306	1	.13368055	.02380952	3.7854118×10^{-3}	3.0688833×10^{-6}
1 foot³	28.31605	7.4805195	1	.1781076	.028316847	2.2956841×10^{-5}
1 barrel (oil)	158.9828	42	5.614583	1	.15898729	1.288930×10^{-4}
1 meter³	999.972	264.17205	35.314667	6.2898107	1	8.1071319×10^{-4}
1 acre foot	1233447	325851.43	43560	7758.367	1233.4818	1

At present both wells are being production tested under the guidance of two geothermal engineers brought in from New Zealand for consultation on wet systems completion methods.

IMPERIAL COUNTY, CALIFORNIA

Bureau of Reclamation

Recently, one of the pilot desalination plants at the Federal Bureau of Reclamation's well "Mesa" 6-1 was tested (see Hot Line v. 3, nos. 2 & 3). The multistage flash unit was put into operation and the water produced initially from this unit was tested at approximately 200 ppm total solids.

Bureau of Reclamation

In early July the Bureau of Reclamation spudded well "Mesa" 6-2 about 2415 m. (1500 ft.) west of "Mesa" 6-1, which was drilled in 1972 to 2448 m.

The new well will be drilled to around 1825 m. and, depending on several contingencies, will be used either as a waste brine disposal well or as a producer.

LAKE COUNTY, CALIFORNIA

The Geysers Geothermal Field -
Pacific Energy Corporation

Pacific Energy Corporation, for economic reasons, decided to abandon their well, "Kettenhoffen" 1, which was sited near Mt. Konocti, a Pleistocene volcano (see Hot Line v. 3, nos. 1, 2, & 3).

This well was drilled originally by Eureka-Magma Explorers in 1971. Subsequently, it was taken over by Getty Oil Company and deepened. PEC acquired the well in November, 1972 with the intention of deepening it, but due to wet weather they were unable to begin drilling until late April 1973. After reaching a depth of 2610 m., a series of drilling problems forced PEC to abandon the hole. It is not known if further exploratory drilling on this lease block is planned.

The Geysers Geothermal Field
Signal Oil & Gas Company

Signal Oil & Gas Company plans to commence drilling again in the Castle Rock Springs area of The Geysers Field next month. At present 3 additional wells are programmed to augment present potential production for Powerplant Unit 13, which has not yet been sited (see Hot Line v. 3, n. 2).

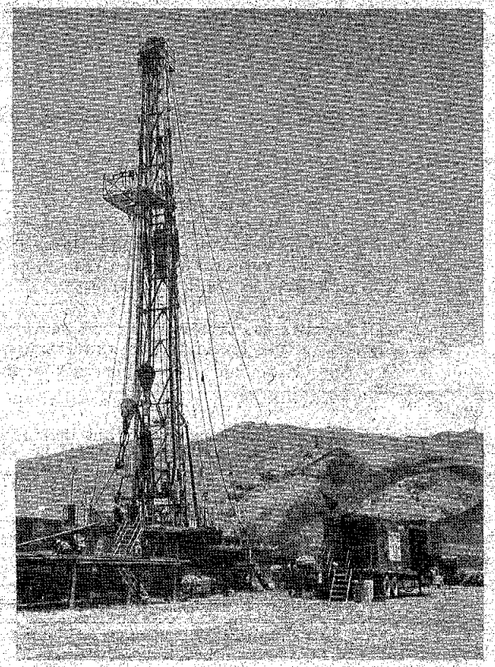
LASSEN COUNTY, CALIFORNIA

Gulf Oil Company

On June 16th Gulf Oil Company spudded "Honey Lake" 1-ST near Amedee Hot Springs in Sec. 5, T. 28 N., R. 16 E., M.D.B. & M. After setting 13 3/8" conductor at 2.8 m. and 9 5/8" surface casing at 306 m. the well was drilled to an undisclosed depth. Downhole surveys were made and on July 7th Gulf abandoned the well. This was their first venture into geothermal exploration.

Subsequently, the rig was moved 4.8 km (3 mi.) northwest and set up, near Wendel Hot Springs, to drill their "Honey Lake" 2-ST location. The well was spudded on July 10th, conductor and surface casing were set, and at present drilling is continuing.

Once the drilling of this well is completed the hole is surveyed and, the rig will be moved about 160 km (100 mi.) north to Surprise Valley, where it will be used to drill Gulf's "Surprise Valley" 1-ST and 2-ST (see Hot Line v. 3, nos. 2 & 3).



Big Chief Drilling Company, Rig 18 on Gulf Oil Company's "Honey Lake" 1-ST near Amedee Hot Springs. This well, spudded in mid-June, was Gulf's first geothermal drilling venture.

MENDOCINO COUNTY, CALIFORNIA

Sun Oil Company

Recently, Sun Oil Company of Dallas, Texas reached an agreement with the French-owned Al-Aquitaine to jointly drill two wells, later this year, in the Tyler Creek area of southeastern Mendocino County. This area is approximately 13 km (8 mi.) northwest of steam production in The Geysers Geothermal Field.

Last year Sun, under the name of Cordero Mining Company, drilled well "Torchio-Ferro" 1, in this area to a depth of 2422 m. This well, which was located 577 m. (1892 ft.) N. and 580 m. (1902 ft.) W. from the SE cor. Sec. 24, T. 12 N., R. 10 W., M.D.B. & M., was abandoned August 14, 1972.

MODOC COUNTY, CALIFORNIA

Magma Energy, Inc.

After a delay of several months, Magma Energy, Inc. has resumed work on their well, "Phipps" 2, in Surprise Valley (see Hot Line v. 3, n. 1). Work was stopped last January when, while running temperature surveys, cavings formed a bridge in the hole, making it impossible to run the temperature probe to total depth. Because of inclement weather, operations were suspended until Spring. Further delays were caused by Magma's on-going well operations in the Salton Sea area of southern California. In mid-July a small rig was moved over "Phipps" 2 and it is now being cleaned out so that a complete temperature survey can be made.

SONOMA COUNTY, CALIFORNIA

The Geysers Geothermal Field -
Geothermal Kinetics Systems Corporation

California law now requires that an Environmental Impact Report (EIR) be written for any proposed project requiring the issuance of a permit. The authority to approve or not approve an EIR is left with the counties.

Geothermal Kinetics has submitted an EIR, covering their area of interest in The Geysers Field, to the Sonoma County Board of Supervisors and it is anticipated that this report will soon be approved.

In August GKS plans to commence drilling their well, "Rorabaugh" 1, which will be their first well in The Geysers Field.

The well will be located 158 m. (520 ft.) S. and 186 m. (610 ft.) W. from the E 1/4 corner of Sec. 14, T. 11 N., R. 9 W., M.D.B. & M.

Subsequent wells will be drilled on a rig-availability basis.

STATE OF CALIFORNIA
DIVISION OF OIL AND GAS
1416 NINTH STREET, ROOM 1316-35
SACRAMENTO, CALIFORNIA 95814

The Geysers Geothermal Field -
Pacific Energy Corporation

In mid-July Pacific Energy Corporation plans to spud "Rorabaugh" A-7, which will be located 924 m. (3030 ft.) S. and 727 m. (2390 ft.) E. from the NW corner of Sec. 14 T. 11 N., R. 9 W., M.D.B. & M. Production from this new well will augment the present potential production from other PEC wells in Sec. 14 for the proposed Powerplant Unit 15.

P. G. & E. and PEC have concluded negotiations on Unit 15 and it is expected that a contract will be signed soon.

Back issues of Geothermal Hot Line are available.

Geothermal Hot Line
A periodic publication of the California Division of Oil and Gas. Subscription price, January through December, $3.

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