

150K
9, 1 160K

DOGAMI \$

Voucher	1 \$	2 \$	3 \$ avail.	4 \$ left	5 billed thru	6 comments	7	8 updated	9
note ESL 1	13,107.64		150,000						
2	9,055.33								
3	2,465.49								
4	2,228.22								
5	99.11								
6	553.45								
note ESL 7	8,113.39								
8	529.13								
9	7185.52								
10	5921.28	49,258.61							
11	9,411.94	58,670.55	+160,000					9/24/85	Mod. 1
12	14,025.90	72,696.45	310,000		8-30-85			11-6-85	
13	8,061.48	80,757.93		229,242.07				11-7-85	(P.B. phone conv.)
14	12,273.54	93,031.47		216,968.53	10-31-85			12-6-85	" " "
15	7,855.66	100,887.13	v.w. ID	209,112.34				1-3-86	PB phone conv. @ESL Jan 8
16	8,755.91	109,643.04		200,356.43				2-5-86	ESL 12 Feb PB phone 5 Feb. 86
17	5,313.15	114,956.19		195,043.28	2-28-86			4-4-86	ID Apr 2 86 ESL 1.4.86
18	8,749.70	123,705.89		186,293.58	3-31-86				nb - slight (7) discrepancy betw DOE & GP DOE MAR 27, '86
19	8,405.77	132,111.66		177,887.81					
20	7,498.58	139,610.24		170,389.26				@DOE 7-21-86	
21	5,971.11	145,581.35		164,418.15				" 8-7-86	
22	6,936.34	152,517.69		157,482.31				" 9-4-86	
24			\$ 149,357	205,807.00 206,839.31	DOE HR	9/11/86 mod 2		9-11/86	
24	1-		359,357					9-11/86	Total DOE Obl:
23	15,483.68	168,001.37		191,355.63	8/1-8/30	PMB → HR 10/15/86			@ESL 10/17/86
24	10,539.43	178,540.80		180,816.20	9/1-9/30				@ESL 11/10/86
25	15,372.89	193,913.69		165,443.31	10/1-10/31				@ESL 12/05/86
26	7,968.28	201,881.97		157,475.03	Adj 01/15/87			3/5/86 by J.D. m. r. c. 1/15/87 TTL	@ESL 1/15/87
26	7,762.89	209,644.86		149,712.14					@ESL 1/15/87
27	4,501.99	214,146.85		145,210.15					@ESL 3/5/87
28	2,054.34	216,201.19		143,155.81					@ESL 3/17/87

Report to Susan
Prestwich
re DOGAMI
9/4/86

EFFICIENCY LINE® 22-206
AMRAD

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108-1295
TELEPHONE 801-524-3422

October 19, 1988

Dr. George R. Priest
Regional Geologist
Department of Geology and Mineral Industries
910 State Office Building
1400 SW 5th Ave.
Portland OR 97201-5528

Dear George:

Thank you for the opportunity to review your draft final report for USDOE Contract DE-FG07-84ID12526. This report provides a thorough description of the DOE grant and its modifications, and ties all the tasks to DOGAMI deliverables. The highlights of the studies are nicely summarized in brief and reference is made to the appropriate DOGAMI publication or map for additional details. This report should be a useful reference for anyone interested in the geothermal potential or volcanic geology of the Oregon Cascades.

The format of your final report (in draft form) is somewhat different from other final reports submitted to DOE, but this is appropriate since all the technical details and specific conclusions are reported in DOGAMI publications. The format suggests that this report may not be a specific DOGAMI publication, but rather a stand-alone Final Report to DOE. With this in mind, and because final reports to DOE are submitted to the DOE Technical Information Center (Oak Ridge, TN) for archival storage and possible printing and distribution, I have a few recommendations regarding format and other comments (attached). Please call me to discuss any of these comments in more detail.

George, if you anticipate any major delays in completing this report or in submitting DOGAMI O.F. 0-88-5 please let me know so we can discuss the need for a no cost time extension.

Page 2
October 19, 1988
H. P. Ross

Thanks again for the opportunity to review and comment on your final report. It looks like all the deliverables for this 1984 grant will soon be completed.

Sincerely,

Howard

Howard P. Ross
Project Manager

encl.

cc: Ken Taylor

Review Comments

Draft Final Report for Grant DE-FG07-84ID12526, Geothermal Research, Oregon Cascades.

Format

- The final report should have: a cover page; Table of Contents; Disclaimer Statement (see NTIC reports). The Grant Number should be included on the cover page.
- The DISCUSSION section is the body of the report, in which several separate topics are discussed. Appropriate subheadings would help to structure this section and would guide the reader. In the order discussed, the subheadings appear to be:

Previous Studies

Interpretation of Geologic Mapping and Heat Flow Studies

Geologic Mapping

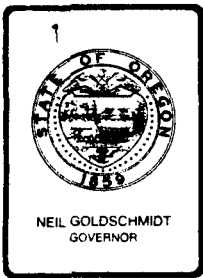
Cascades Scientific Drilling

- List the references for any publications cited in the text (i.e., Blackwell et al., 1982) but not fully identified.
- A Bibliography of DOGAMI reports and maps generated under this grant would be desirable, and could follow the Conclusions. A listing of other papers and presentations (GRC, GSA, AGU) resulting from this work would also be appropriate and desirable.

Typos, etc.

- Page 4, line 1. These data indicate...
Page 4, line 18. These data ...
Page 8, item 2. the heat source
Page 8, item 5. convergence so that ...
Page 11, item 8. is necessary to better understand

Pages 2, 5, 10. The symbol for approximate (~) should be lowered to mid-line level as so (~).



Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

January 6, 1988

Dr. Marshall J. Reed
Division of Geothermal and Hydrothermal Technologies
U.S. Department of Energy
CE-324, Mail Stop 6B-025
1000 Independence Avenue, SW
Washington, D.C. 20585

Dear Marshall:

Enclosed are five copies of the colored version of our Crescent Mountain geologic map. This adjoins the south side of the Breitenbush River map already sent to you. If you combine the two maps, you will be able to see the structure of the west side of the High Cascade graben where it terminates northward at the latitude of Mount Jefferson. The graben formed about 4 m.y. ago. Water and sediments discharged from the graben through a break in its western wall at the latitude of McKenzie Bridge, Oregon, south of the enclosed maps. By about 2 m.y. ago, the ancestral McKenzie River had cut a valley through the western escarpment bounding the graben. This valley was at base level and about as deep and wide as the modern valley which flows to Eugene across the Western Cascades. The influx of volcanoclastic rocks and lavas into this valley between about 2 Ma. and 1.6 Ma. overcame the capacity of the river, causing aggradation to the top of the valley walls all the way back to the headwaters in the Crescent Mountain geologic map (see the Parkett Creek sedimentary rocks). We even have some evidence that sediments and one ash flow spilled over the tops of valley-bounding ridges into adjacent Western Cascade valleys near McKenzie Bridge. Pleistocene rivers were able to recut the valley to the 2 Ma. base level by about 75,000-12,000 y. ago.

Many of the above interpretations are based on data from the colored geologic map of the McKenzie Bridge quadrangle, which is due for publication in April. That map will also show a convincing correlation of all hot springs in the graben area with graben-bounding faults. It is clear that thermal aquifers from the High Cascades are locally hitting barriers at the graben margins and flowing upward along fractured rocks in the graben block. The detailed geologic maps show these faults with far greater accuracy than any previous work.

Dr. Marshall Reed
Januray 6, 1988
page 2

We hope to present this and other data on the basic geology of the Cascades at a workshop being planned by the USGS this year. The purpose of the workshop will be to bring together a series of papers for publication in a special issue of a journal such as JGR. I am planning to use this year to get our last 8 years of research into refereed journals. I feel that this will be the most effective way to get the information out and to promote continental scientific drilling in the area.

Contact Craig Weaver at the University of Washington for progress reports on the Cascade workshop. I skillfully delegated organization of it to him at our last meeting of the PSDC group at AGU.

I hope you are as excited about the results of our work in the Cascades as I am. Our next step is to peek beneath the High Cascades by drilling.

Best Regards,

George R. Priest
Regional Geologist

encl.

CC Don Hull
John Beaulieu
Susan Prestwitch

Apr 16/84

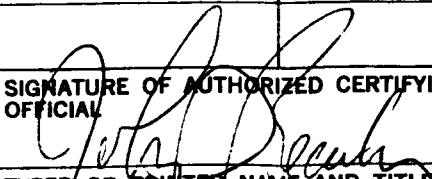
FINANCIAL STATUS REPORT

(Follow instructions on the back)

1. FEDERAL AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH REPORT IS SUBMITTED U.S. Dept. of Energy	2. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER DE=FG07-84ID1256	OMB Approved No. 80-RO180	PAGE 1 OF 1 PAGES
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3. RECIPIENT ORGANIZATION (Name and complete address, including ZIP code) Dept. of Geology and Mineral Industries 910 State Office Building 1400 S.W. Fifth Avenue Portland, OR 97201-5528	4. EMPLOYER IDENTIFICATION NUMBER	5. RECIPIENT ACCOUNT NUMBER OR IDENTIFYING NUMBER	6. FINAL REPORT <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	7. BASIS <input checked="" type="checkbox"/> CASH <input type="checkbox"/> ACCRUAL
	8. PROJECT/GRANT PERIOD (See instructions) FROM (Month, day, year) 6-25-84 TO (Month, day, year) 10-31-88		9. PERIOD COVERED BY THIS REPORT FROM (Month, day, year) 7-1-87 TO (Month, day, year) 6-30-88	

PROGRAMS/FUNCTIONS/ACTIVITIES ▶	10. STATUS OF FUNDS						
	(a)	(b)	(c)	(d)	(e)	(f)	TOTAL (g)
a. Net outlays previously reported	\$ 246,554*	\$	\$	\$	\$	\$	\$
b. Total outlays this report period	58,735						
c. Less: Program income credits	0						
d. Net outlays this report period (Line b minus line c)	58,735						
e. Net outlays to date (Line a plus line d)	305,289						
f. Less: Non-Federal share of outlays	0						
g. Total Federal share of outlays (Line e minus line f)	305,289						
h. Total unliquidated obligations	0						
i. Less: Non-Federal share of unliquidated obligations shown on line h	0						
j. Federal share of unliquidated obligations	0						
k. Total Federal share of outlays and unliquidated obligations	305,289						
l. Total cumulative amount of Federal funds authorized	359,357						
m. Unobligated balance of Federal funds	54,068						

11. INDIRECT EXPENSE	a. TYPE OF RATE (Place "X" in appropriate box) <input type="checkbox"/> PROVISIONAL <input type="checkbox"/> PREDETERMINED <input type="checkbox"/> FINAL <input type="checkbox"/> FIXED				13. CERTIFICATION I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.	SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL 	DATE REPORT SUBMITTED 7-24-88
	b. RATE 18.0%	c. BASE \$49,775	d. TOTAL AMOUNT \$8,960	e. FEDERAL SHARE \$8,960			
12. REMARKS: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.							

*Previously reported figure of \$248,518 was in error.

U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE MANAGEMENT SUMMARY REPORT

1. Program/Project Identification No. DE-FG07-84ID12526	2. Program/Project Title GEOHERMAL RESEARCH - OREGON CASCADES	3. Reporting Period 4/88 through 11/88
4. Name and Address GEORGE R. PRIEST - DEPT. OF GEOLOGY 1400 SW 5th Ave. 910 State Office Bldg. Portland, OR 97201		5. Program/Project Start Date 6/25/84
		6. Completion Date 10/31/88

7. FY 87-88	8. Months or Quarters MONTHS														
9. Cost Status a. Dollars Expressed In THOUSANDS		b. Dollar Scale ↓													
10. Cost Chart		<table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%;"></td> <td style="width:10%; text-align:center;">J</td> <td style="width:10%; text-align:center;">A</td> <td style="width:10%; text-align:center;">S</td> <td style="width:10%; text-align:center;">O</td> <td style="width:10%; text-align:center;">N</td> <td style="width:10%; text-align:center;">D</td> <td style="width:10%; text-align:center;">J</td> <td style="width:10%; text-align:center;">F</td> <td style="width:10%; text-align:center;">M</td> <td style="width:10%; text-align:center;">A</td> <td style="width:10%; text-align:center;">M</td> <td style="width:10%; text-align:center;">J</td> </tr> </table>		J	A	S	O	N	D	J	F	M	A	M	J
	J	A	S	O	N	D	J	F	M	A	M	J			
Fund Source	Quarter	Cum. to Date	Tot. Plan												
	1st	2nd	3rd	4th											
USDOE	P	299	314	327	342	400									
	A	261	276	280	305										
	P					300									
	A														
	P					200									
	A														
	Total P	299	314	327	342										
	Total A	261	276	280	305										
	Variance	38	38	47	37										
		P = Planned A = Actual													
Total Planned Costs for Program/Project		Planned	288	294	299	304	309	314	319	321	327	332	337	342	
		Actual	249	255	261	265	267	276	277	279	280	288	296	305	
		Variance	39	39	38	39	42	38	42	43	47	44	41	37	
\$ 359,357															

11. Major Milestone Status	Units Planned	
Geologic Map-Santiam Jtn	Units Complete	Complete
	P	
Geologic Map-Breitenbush	C	Complete
	P	
Temperature Data Collection	C	Complete
	P	
Geologic Map-Ollalie Butte	C	
	P	
Well core studies	C	
	P	
Report - CIG well	C	
	P	
Reporting	C	
	P	
Geologic Map-McKenzie Bridge	C	
	P	
	C	
	P	
	C	
	P	
	C	
	P	
	C	
	P	
	C	
	P	
	C	
	P	
	C	

12. Remarks

13. Signature of Recipient and Date <i>George R. Priest 7-26-88</i>	14. Signature of DOE Reviewing Representative and Date
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U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE PROGRAM/PROJECT STATUS REPORT

FORM EIA-480F
11/83

FORM APPROVED
OMB No. 1988-0127

1. Program/Project Identification No. DE - FG07-84ID12526	2. Program/Project Title GEOTHERMAL RESEARCH, OREGON CASCADES	3. Reporting Period 4/88 through 6/88
4. Name and Address GEORGE R. PRIEST - Dept. of Geology 1400 SW 5th Ave. - 910 State Office Bldg. Portland, OR 97201		5. Program/Project Start Date 6/25/84 6. Completion Date 10/31/88

7. Approach Changes

None

8. Performance Variances, Accomplishments, or Problems

None

9. Open Items

None

10. Status Assessment and Forecast

All tasks are on schedule. Deliverables will be ready by the end of the grant period on October 31, 1988.

The colored geologic map of the McKenzie Bridge 15' quadrangle is nearly through typesetting and will be printed within a short time.

The synthesis of data on the CTGH-1 hole and the adjacent Breitenbush-Austin Hot Springs area is in review. The report will be submitted on schedule.

No Deviation from Plan is Expected

11. Description of Attachments

None

12. Signature of Recipient and Date <i>George R. Priest 7-26-88</i>	13. Signature of DOE Reviewing Representative and Date
--	--



Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

October 14, 1988

Mr. Kenneth Taylor
U.S Department of Energy
Idaho Operations Office
785 DEO Place
Idaho Falls, ID 83402

Dear Mr. Taylor,

Subject: Draft Final Report for USDOE contract DE-FG07-84ID12526, Geothermal Research, Cascade Range

Please find enclosed a copy of the draft final report for USDOE contract DE-FG07-84ID12526, Geothermal Research, Cascade Range, for your review.

Please contact me if you have any questions.

Sincerely,

George R. Priest
Regional Geologist

c: Jeff Hoyles
Marshall Reed
Howard Ross

Enclosure

FINAL REPORT FOR GRANT DE-FG07-84ID12526, GEOTHERMAL RESEARCH,
OREGON CASCADES

INTRODUCTION

Grant DE-FG07-84ID12526, for Geothermal Research in the Oregon Cascades, was awarded to the Oregon Department of Geology and Mineral Industries (DOGAMI) on June 26, 1984. The original project period was from June 25, 1984 through June 25, 1986. Deliverables included two geologic maps at a scale of 1:62,500, one geologic map at a scale of 1:24,000, and a compilation of new temperature-gradient and heat flow data. Modification M001 to the original grant extended the project period to April 30, 1988. Additional required deliverables were a geologic map of the McKenzie Bridge Quadrangle at a scale of 1:62,500, and a feasibility plan for scientific drilling in the Cascade Range.

In 1987 DOGAMI published the two required 1:62,500-scale geologic maps. The maps are GMS-46, Geologic map of the Breitenbush River area, Linn and Marion Counties, Oregon (scale 1:62,500), which was funded by DOGAMI, and GMS-47, Geologic map of the Crescent Mountain area, Linn County, Oregon (scale 1:62,500). The required 1:24,000-scale geologic map was also published in 1987 as part of DOGAMI Special Paper 21, Field geology of the northwest quarter of the Broken Top 15' Quadrangle, Deschutes County, Oregon (scale 1:24,000). These maps, which fulfilled Task 1.1 of the Deliverables section of the unamended grant were submitted to the Idaho Operations Office of USDOE on August 4, 1987.

The required compilation of temperature gradient data, task 1.2 of the Deliverables section of the unamended grant, was published in 1986 as DOGAMI Open-File Report O-86-2 (Geothermal-gradient data for Oregon (1982-1986)). This report was also submitted to USDOE on August 4, 1987.

The required feasibility plan for scientific drilling in the Cascades was also submitted to USDOE on August 4, 1987. The plan was published as DOGAMI Open-File Report O-86-3, Investigation of the thermal regime and geologic history of the Cascade volcanic arc: First phase of a program for scientific drilling in the Cascade Range. A second, unnumbered, DOGAMI publication titled "A program for scientific drilling in the Cascades, northern California, Oregon, and Washington" was also published at the same time and submitted to USDOE on August 4, 1987.

The above publications constitute fulfillment of Task 1.1 of the Deliverables section of Amendment M001. Task 1.2 of the Deliverables section of Amendment M001 is fulfilled by DOGAMI publication GMS-48, Geologic map of the McKenzie Bridge quadrangle, Lane County, Oregon. This map was printed in October, 1988, and is part of the final submission to USDOE.

Amendment A002 to the original grant extended the project period to July 31, 1988, and added the following additional tasks: I. Prepare a geologic map of ~15 square miles centered on the site of the Clackamas temperature-gradient hole (CTGH-1) at T8S R8E NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 28, at a scale of 1:24,000. II. Conduct studies on rocks and well core to define lithologic units. III. Produce a comprehensive report containing geologic and geothermal

implications and possible geologic models. DOGAMI Open-File Report O-88-5, Geology and geothermal resources of the Breitenbush-Austin Hot Springs area, Clackamas and Marion Counties, Oregon, which is part of the final submission to USDOE, fulfills Tasks I-III above.

Modification M003 adjusted the due date for the deliverables identified under Task 1.1 of the original grant to August 1, 1987. Modification M004 revised the budget categories with no increase in obligated funds. Modification M005 extended the delivery date for the CTGH-1 studies to October 31, 1988. Modification M006 extended the delivery date for the McKenzie Bridge map to the same date.

In subsequent sections we will discuss models of Cascade Range heat flow that have been developed as a result of USDOE-funded geothermal research, and the bearing of research completed for this grant on those models. We will also discuss the importance of the geologic mapping that has been completed and how this mapping may affect future geothermal exploration. Finally we will discuss the scientific plan developed for deep drilling in the Cascade Range.

DISCUSSION

Previous Studies
Previous USDOE-funded geothermal studies have produced an extensive temperature gradient and heat flow data base for the State of Oregon. One of the important features identified as a result of these studies is a rapid transition from heat flow values on the order of 40 mW/m^2 in the Willamette Valley and Western Cascades to values of $\geq 100 \text{ mW/m}^2$ in the High Cascades and

the eastern portion of the Western Cascades. This^{ese} data indicate that the Cascade Range in Oregon has potential as a major geothermal province and stimulated much of the later work completed by government agencies and private industry.

Interpretation of Geologic Mapping and Heat Flow Studies
 # Additional data generated as a result of this grant and published in DOGAMI Open-File Report O-86-2 further define the location and magnitude of this transition zone. In addition, abundant data collected from the vicinity of Breitenbush and Austin Hot Springs have permitted the formulation of relatively detailed models of these hydrothermal systems. These models are published in DOGAMI Open-File Report O-88-5 and will be discussed in a later section.

Detailed geologic mapping by Priest and others (1987) in the vicinity of Breitenbush Hot Springs (DOGAMI GMS-46) determined that thermal fluids emerge from fractures in a basaltic sequence near its contact with an underlying tuffaceous unit. A deep production test by Sunoco Energy Development Company (Sunedco 58-28) east of Breitenbush Hot Springs encountered a thermal aquifer in nearly the same stratigraphic position. This^{ese} data, along with other shallow temperature-gradient data published in DOGAMI Open-File Report O-86-2 indicate that there is a thermal aquifer at and east of the Springs that dips approximately 10° to the southeast. A possible interpretation is that thermal fluids flow downward in the High Cascades until they hit the impermeable lower part of this southeast-dipping tuff unit. The fluids then move updip until they intersect the surface at Breitenbush Hot Springs. As they move updip, the fluids would be expected to cool both by conduction and by mixing with cooler shallow

groundwater. Estimated reservoir temperatures for Breitenbush Hot Springs are as high as 176 °C (sulfate-water method). Higher temperatures may therefore be encountered in the aquifer east of the hot springs. The Breitenbush Hot Springs hydrothermal system may thus have significant geothermal potential.

Subsequent to the above interpretation an additional heat flow study was completed D.D. Blackwell and S.L. Baker of Southern Methodist University and published in DOGAMI Open-File Report O-88-5. This study indicates that both Breitenbush and Austin Hot Springs represent distinct local geothermal anomalies that are superimposed on the regional background values of ~ 100 mW/m². The anomalies are dominated by steep horizontal gradients that suggest that the systems are dominated by flow along steep fracture systems, at least to depths of 1-2 km. In the Breitenbush system, an age of $\sim 25,000$ years for flow in the aquifer identified in Sunedco 58-28 is the best-fitting model for the temperature-depth curve. In addition, analysis of the heat-flow data and the temperature profile from Sunedco 58-28 indicate that the Breitenbush system is superficial and that temperatures of ≥ 150 °C will occur only east of the thermal manifestations at depths in excess of 2 km. Blackwell and Baker interpret the regional transition in heat flow near the Western Cascade-High Cascade boundary as relating to midcrustal sources that underlie the entire area of the high heat flow zone, and not to upper crustal groundwater flow, unless the major portion of such flow is at depths of ≥ 3 km and at temperatures in excess of 200 °C.

An alternative interpretation of the regional heat flow data set is discussed by D.R. Sherrod, also in DOGAMI Open-File Report O-88-5. Sherrod notes that oxygen and deuterium isotope studies indicate that water discharging at Breitenbush Hot Springs originates as precipitation near the range crest in the High Cascades. In his interpretation the water circulates vertically downward beneath the High Cascades, where it is warmed by heat sources associated with and essentially directly beneath the young volcanos of the range. The water then flows laterally along permeable zones and eventually emerges at the line of hot springs in the Western Cascades.

The implications of the two models for geothermal exploration are important. Blackwell envisions a midcrustal heat source beneath the entire High Cascade province and the eastern portion of the Western Cascade province. Therefore there is geothermal potential virtually anywhere that adequate permeability is encountered. The other model implies that there is significant geothermal potential only beneath the youngest part of the High Cascade Range. Further research will be needed to discriminate between the two models.

Other studies in DOGAMI Open-File Report O-88-5 discuss the geology of the CTGH-1 drillhole, the alteration in the Breitenbush-Austin Hot Springs area, and the alteration in the CTGH-1 drillhole. The geologic studies add to the sound stratigraphic framework established by earlier USGS and DOGAMI mapping. The regional alteration studies indicate that rocks once buried 1-2 km had temperatures that locally exceeded 200 °C,

but that these temperatures occurred prior to middle Miocene folding of the rocks and is not related to the present day geothermal systems. The alteration mineralogy of the CTGH-1 drill core indicates that downhole temperatures have never exceeded those measured today, which are about 100 °C.

Geologic Mapping
As part of this grant, DOGAMI has published a total of five geologic maps. These include geologic maps of the Breitenbush Hot Springs area (GMS-46), the Crescent Mountain area (GMS-47), and McKenzie Bridge (GMS-48), all at a scale of 1:62,500; and maps of the northwest one quarter of the Broken Top quadrangle (Special Paper 21) and the area around the CTGH-1 drillhole at a scale of 1:24,000 (Open-File Report O-88-5). These publications represent some of the most detailed mapping yet completed in the Cascade Range of Oregon. They establish a firm stratigraphic basis for further geothermal studies. In addition, the 1:62,500 scale maps of the High Cascade-Western Cascade transition zone have identified a series of north-south trending normal faults that define the position of the western margin of the High Cascade graben. If the heat flow model of Blackwell and others (1982) is correct and there is a mid-crustal heat source beneath the High Cascades and the eastern portion of the Western Cascades, then these faults, possibly representing zones of vertical permeability, possess significant geothermal potential. *ref?*

The map of the northwest one quarter of the Broken Top quadrangle represents the first detailed mapping of portions of the "silicic highland" that occurs between the South Sister and Bend, Oregon. It is becoming increasingly clear from other

geologic studies in the area that the silicic highland is the source of the voluminous young ash-flow tuffs that crop out in the vicinity of Bend. If so, the silicic highland may become the next site of intense geothermal exploration in Oregon.

Cascades Scientific Drilling

DOGAMI Open File Report 8-86-3, Investigation of the thermal regime and geologic history of the Cascade volcanic arc: first phase of a program for scientific drilling in the Cascade Range, was published in 1987. In it, a phased program of drilling and surface surveys was proposed to advance understanding of the thermal regime, volcanic history, metamorphic processes, and tectonic setting of the Cascade Range of Washington, Oregon, and northern California. The following general objectives were identified:

1. Estimation of the regional background heat flow in parts of the Quaternary volcanic belt dominated by basalt and basaltic andesite.
2. Investigation of the nature of the heat^t source responsible for the regional heat flow anomaly.
3. Characterization of regional hydrothermal circulation and attendant water-rock reactions.
4. Comparison of the rate of volcanism to the rate and direction of plate convergence.
5. Comparison of data from items 1 and 4 to similar data from areas with differing rates and directions of plate convergence ^{to} that a comprehensive model can be developed. ₅₀
6. Comparison of the history of deformation and magma genesis in the volcanic arc to the history of subduction.
7. Determination of the stress regime of the volcanic arc to evaluate how the arc is responding to regional tectonic forces, particularly interactions of the Juan de Fuca and North American plates.

8. Determination of the current configuration of the subducted oceanic plate in order to understand its relationship to the distribution of heat flow, Quaternary volcanism, and quaternary deformation.

The plan detailed an extensive first phase of investigation. Proposed second and third phases were discussed in more general terms.

The first phase is to consist of a coordinated program of drilling and surface geological and geophysical surveys of two study areas. The first is Santiam Pass, in central Oregon, and the second is the Breitenbush Hot Springs area. The plan set forth four primary drilling tasks and seven additional tasks, as follows:

1. Drill four 1.2 km-deep diamond core holes in an east-west transect through Santiam Pass.
2. Drill one 2.7 km deep hole in the High Cascades near Santiam Pass.
3. Drill a 2.0 km hole southeast of Breitenbush Hot Springs.
4. Sample the hydrothermal aquifer at 760 m in Sunedco 59-28.
5. Conduct in situ stress tests.
6. Complete geologic coverage of the Western Cascades and High Cascades at the latitude of Santiam Pass.
7. Study hydrothermal alteration in drillholes and outcrops at Santiam Pass.
8. Determine configuration and evolution of current hydrothermal systems in the study areas.
9. Conduct detailed electrical, gravity, and seismic surveys in the Santiam Pass transect.
10. Conduct a regional seismic experiment capable of mapping the subducted oceanic plate, gross crustal structure, and magma bodies in the crust and upper mantle.

11. Measure paleomagnetic-pole orientations in rocks from a variety of stratigraphic and geographic positions in the central part of the Cascade Range to test for rotation of major tectonic blocks.

As set forth in the plan, the program was to be managed by the Scientific Steering Committee (SSC), which is to be composed of representatives from the major participating organizations. It is anticipated that Phase I would cost approximately \$11.5 million and take about five years to complete.

CONCLUSIONS

Conclusions resulting from studies funded by this grant are summarized as follows:

1. The preferred model for Breitenbush Hot Springs is one where meteoric water falling on the High Cascades is warmed by heat sources associated with High Cascades volcanism. The water descends until it reaches a zone of relatively impermeable tuffs. The water then moves updip along the contact of the tuff with overlying rocks. As the water ascends, it is cooled by conduction and by mixing with cooler groundwater. Breitenbush Hot Spring marks the point where the tuff contact intersects the surface of the earth.

2. Both Breitenbush and Austin Hot Springs represent local thermal anomalies that are superimposed on the regional background heat flow values of $\sim 100 \text{ mW/m}^2$. The anomalies are dominated by steep horizontal gradients that suggest that the systems are dominated by flow along steep fracture systems. The best age for the inception of flow in the aquifer encountered in Sunedco 58-28 is 25,000 years. In the Breitenbush system, temperatures in excess of 200°C will occur only east of the surface thermal manifestations at depths in excess of 2 km.

3. There are two models to explain the regional heat flow data. In one there is a mid-crustal heat source associated with the entire zone of high heat flow. In the second, there is a heat source only beneath the axis of the High Cascade Range. The remainder of the high heat flow anomaly results from the lateral flow of ground water at depth. At the present time, we prefer the first model. It seems unlikely that lateral groundwater flow

can account for the uniformity of the magnitude of high heat flow anomaly, and the abruptness and north-south continuity of the transition from lower to higher heat flow. Further deep drilling in the High Cascades and eastern portion of the Western Cascades is needed to determine which model is correct.

4. The two models discussed above have profound implications for geothermal exploration. In the first, there is significant geothermal potential beneath the entire zone of high heat flow. In the second there is high potential only beneath the axis of the High Cascades.

5. Alteration studies in CTGH-1 indicate that downhole temperatures have never exceeded those measured today, approximately 100 °C. Regional alteration studies in the Breitenbush area indicate that rocks once buried at depths of 1-2 km had temperatures that locally exceeded 200 °C, but that these temperatures occurred prior to middle Miocene folding of the rocks and are not related to present day geothermal systems.

6. There are large down-to-the-east normal faults associated with the western margin of the High Cascade Range. Fracture permeability associated with these fault systems may have significant geothermal potential.

7. There may be significant geothermal potential associated with the "silicic highland", lying between South Sister and Bend, Oregon.

8. Deep drilling in the High Cascade Range is necessary to better understand the thermal regime, volcanic history, metamorphic processes, and tectonic setting. The first phase of this drilling should be centered on the High Cascade axis at Santiam Pass, Oregon

Heggy 23



**Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE**

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

October 9, 1987

Trudy A. Thorne
Contracts Management Division
U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

Dear Trudy:

Regarding our application for support from PRDA No. DE-PR07-87ID12662 for a drilling project, your office elected not to support the key drilling task. You offered instead modest support for drill-site selection studies.

The basic plan outlined in our proposal had been reviewed by the Cascade Task Force, an ad hoc group of interested scientists from national laboratories, state agencies, universities, and the U.S. Geological Survey. This group felt that the proposed work would be an important step toward accomplishment of the goals of the Program for Scientific Drilling in the Cascades (PSDC). After consultation with members of the Task Force and our own staff, it is clear that the project cannot be undertaken with piecemeal funding.

It is with deep regret that we must therefore withdraw from consideration under the auspices of PRDA No. DE-PR07-87ID12662.

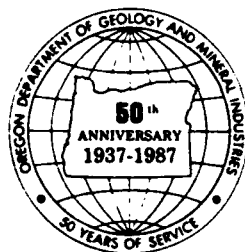
We understand that the Oregon Department of Energy (ODOE) also submitted a proposal, under this PRDA to your office. Their proposed work would help direct-use geothermal development in the state. We request that the ODOE proposal be funded.

Thank you for your consideration.

Sincerely,

Donald A. Hull
State Geologist

CC Marshall Reed
Susan Prestwich
George Priest
John Beaulieu





Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

August 4, 1987

8/7/87

Susan Prestwitch
Program Manager
U.S. Dept. of Energy
Idaho Operations Office
Energy and Technology Division
550 Second St.
Idaho Falls, ID 83401

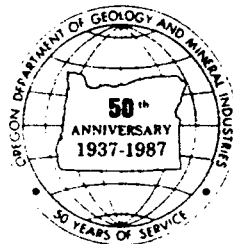
Rec

Dear Susan:

Enclosed are the quarterly and yearly financial reports as well as 5 copies of all of the deliverables due at this time on Grant No. DE-FGO7-84ID12526. The deliverables include:

1. Geologic map of the North Santiam-Breitenbush River area (reference Task 1.1, "two geologic maps at the 1:62,500 scale," of Deliverables section, unamended grant)
2. Geologic map of the Crescent Mountain-Coffin Mountain area (reference Task 1.1, "two geologic maps at the 1:62,500 scale," of Deliverables section, unamended grant)
3. Geologic map of the northwest quarter of the Broken Top quadrangle (reference Task 1.1, "one map at the 1:24,000-scale," of Deliverables section, unamended grant)
4. Open-File Report summarizing all new temperature-depth data (reference Task 1.2 of Deliverables section, unamended grant).
5. Scientific drilling plan (reference Task 1.1, feasibility study of Deliverables section of Amendment No. M001).

As you requested, I have sent three of your eight camera-ready copies to the USDOE Technical Information Center in Oak Ridge, Tennessee. As specified on page 4 of the original contract, 1 copy of each deliverable was sent to Howard Ross and Jeff Hoyles, and 6 copies were sent to Marshall Reed. They will each receive this letter with their copies.



DOGAMI - M001-2-

<u>REPORT</u>	<u>DUE</u>
Form DOE 538 Notice of Energy RD&D	30 days after award of addition to grant .
Quarterly Management Summary Report	15 days after calendar quarter end
Project Status Report	15 days after calendar quarter end
Feasibility Study Plan	12-31-85
3 Geologic Maps, as described in 6-25-84 original grant	6-22-86
Final Report (draft)	45 days prior to completion date of this addition to grant
Compilation of Temperature-Depth Data and Heat-Flow Values	On completion date of this addition to grant
1 Geologic Map of McKenzie Bridge 15' Quadrangle	On completion date of this addition to grant
Final Report - to include all work from 6-25-84 to completion date (scheduled for 9-30-87)	On completion date of this addition to grant (scheduled for 9-30-87)

2.0. Deliverables:

The following deliverables will be added to those previously specified under this grant.

rec. 8/17/87
Task 1.1. Feasibility Study: The deliverable for this task will be a printed scientific plan for further research, particularly scientific drilling, in the Cascades of Washington, Oregon, and California. The plan will be delivered to U.S. DOE by 12-31-85. The plan will include all information and be presented in a fashion consistent with professional geological practices.

due to Final
Task 1.2. Geologic Map Preparation: The deliverable for this task will be a colored geologic map of the McKenzie Bridge 15' Quadrangle complete with supporting data, description, and interpretation. Some of the supporting information may be contained in a separate publication. This map will be delivered to U.S. DOE at the end of the contract.

Task 1.3. Project Management and Reporting: Reports described in paragraph 1.3. will be prepared and issued in the amounts and at the frequency shown. The deliverables noted herein (2.0 Deliverables) are also mentioned in paragraph 1.3. along with those due under the original grant which commenced 6-25-84.

U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE REPORTING CHECKLIST

FORM EIA-469A
 (10/80)

FORM APPROVED
 OMB NO. 1900-0127

1. Identification Number: DE-FG07-84ID12526		2. Program/Project Title: Geothermal Research, Cascade Range	
3. Recipient: State of Oregon, Department of Geology & Mineral Industries			
4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
<input type="checkbox"/> Federal Assistance Milestone Plan			
<input type="checkbox"/> Federal Assistance Budget Information Form			
<input checked="" type="checkbox"/> Federal Assistance Management Summary Report	Q	1,1,1	A,B,C
<input checked="" type="checkbox"/> Federal Assistance Program/Project Status Report	Q	1,1,1	A,B,D
<input checked="" type="checkbox"/> Financial Status Report, OMB Form 269	Y,F	1,1	A,C
TECHNICAL INFORMATION REPORTING			
<input checked="" type="checkbox"/> Notice of Energy RD&D	Y	1,1	A,E
<input type="checkbox"/> Technical Progress Report			
<input checked="" type="checkbox"/> Topical Report	A*	1,1,1	A,B,D
<input checked="" type="checkbox"/> Final Technical Report (2)	F*	1,1,1	A,B,D
<p>FREQUENCY CODES AND DUE DATES:</p> <p>A - As Necessary; within 5 calendar days after events. F - Final; 90 calendar days after the performance of the effort ends. Q - Quarterly; within 30 days after end of calendar quarter or portion thereof. O - One time after project starts; within 30 days after award. X - Required with proposals or with the application or with significant planning changes. Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days). S - Semiannually; within 30 days after end of program fiscal half year</p>			
<p>5. Special Instructions:</p> <p>Topical Reports will include:</p> <ul style="list-style-type: none"> ✓ Cascades Feasibility Study <i>rel 8/7/87</i> ✓ Geologic Map of McKenzie Bridge Geologic Maps of High Cascades & Western Cascades in the area of Coffin Mountain Geologic Map of Eastern Flanks of High Cascades... <p>*Include one camera-ready copy</p>			
6. Prepared by: (Signature and Date)		7. Reviewed by: (Signature and Date)	

M001

REPORT DISTRIBUTION LIST

DE-FG07-84ID12526

U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

- A ATTN: Peggy Brookshier, Program Manager
 Energy & Technology Division
- B ATTN: Ronald A. King
 Contracts Management Division
- C ATTN: E. G. Jones, Director
 Financial Management Division
- D University of Utah Research Institute
 Earth Science Laboratory
 391 Chipeta Way, Suite A
 Salt Lake City, UT 84108
 ATTN: Duncan Foley
- E U. S. Department of Energy
 Technical Information Center
 P.O. Box 62
 Oak Ridge, TN 37830

NOTICE OF FINANCIAL ASSISTANCE AWARD
(See Instructions on Reverse)

Under the authority of Public Law 93-410 and
subject to legislation, regulations and policies applicable to (cite legislative program title):

Geothermal Research, Development and Demonstration Act of 1977

PROJECT TITLE <u>Geothermal Research, Cascade Range</u>	2. INSTRUMENT TYPE <input checked="" type="checkbox"/> GRANT <input type="checkbox"/> COOPERATIVE AGREEMENT	
	4. INSTRUMENT NO. <u>DE-FG07-84ID12526</u>	5. AMENDMENT NO. <u>M005</u>
RECIPIENT (Name, address, zip code, area code and telephone no.) <u>State of Oregon Department of Geology and Mineral Industries 1005 State Office Bldg, Portland, OR 97201</u>	6. BUDGET PERIOD FROM <u>9/1/86</u> THRU <u>8/31/87</u>	7. PROJECT PERIOD FROM: <u>6/25/84</u> THRU: <u>10/31/88</u>
RECIPIENT PROJECT DIRECTOR (Name and telephone No.) <u>George R. Priest (503) 229-5580</u>	10. TYPE OF AWARD <input type="checkbox"/> NEW <input type="checkbox"/> CONTINUATION <input type="checkbox"/> RENEWAL <input checked="" type="checkbox"/> REVISION <input type="checkbox"/> SUPPLEMENT	

RECIPIENT BUSINESS OFFICER (Name and telephone No.) <u>John Beaulieu (503) 229-5580</u>	12. ADMINISTERED FOR DOE BY (Name, address, zip code, telephone No.) <u>R. Jeffrey Hoyles U.S. Department of Energy Idaho Operations Office 785 DOE Place Idaho Falls, ID 83402</u>
--	--

DOE PROJECT OFFICER (Name, address, zip code, telephone No.) <u>Susan Prestwich (208) 526-1147 U.S. DOE, Idaho Operations Office 785 DOE Place, Idaho Falls, ID 83402</u>
--

1. RECIPIENT TYPE
 STATE GOV'T INDIAN TRIBAL GOV'T HOSPITAL FOR PROFIT ORGANIZATION INDIVIDUAL
 LOCAL GOV'T INSTITUTION OF HIGHER EDUCATION OTHER NONPROFIT ORGANIZATION C P SP OTHER (Specify)

1. ACCOUNTING AND APPROPRIATIONS DATA				15. EMPLOYER I.D. NUMBER/SSN
a. Appropriation Symbol <u>N/A</u>	b. B & R Number	c. FT/AFP/OC	d. CFA Number	

2. BUDGET AND FUNDING INFORMATION		b. CUMULATIVE DOE OBLIGATIONS	
a. CURRENT BUDGET PERIOD INFORMATION			
) DOE Funds Obligated This Action	\$ <u>-0-</u>	(1) This Budget Period [Total of lines a. (1) and a. (3)]	\$ <u>49,357</u>
) DOE Funds Authorized for Carry Over	\$ <u>205,807</u>	(2) Prior Budget Periods	\$ <u>359,357</u>
) DOE Funds Previously Obligated in this Budget Period	\$ <u>49,357</u>	(3) Project Period to Date [Total of lines b. (1) and b. (2)]	\$ <u>359,357</u>
) DOE Share of Total Approved Budget	\$ <u>205,807</u>		
) Recipient Share of Total Approved Budget	\$ <u>-0-</u>		
) Total Approved Budget	\$ <u>205,807</u>		

3. TOTAL ESTIMATED COST OF PROJECT \$ _____
(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

4. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations (specify) N/A (Date) _____

c. DOE Assistance Regulations, 10 CFR Part 600, as amended, Subparts A and B (Grants) or C (Cooperative Agreements).

d. Application/proposal dated 2/3/87, as submitted with changes as negotiated

5. REMARKS
This modification extends the delivery date for geologic map - Ollalie Butte, well core studies, and CTQ well report (Thermal Power) from 7/31/88 to 10/31/88 to allow for report and printing. All other delivery dates remain the same.

6. EVIDENCE OF RECIPIENT ACCEPTANCE

Donald A. Hull 8/31/87
(Signature of Authorized Recipient Official) (Date)

Donald A. Hull 8/31/87
(Name) (Date)

State Geologist
(Title)

21. AWARDED BY

R. Jeffrey Hoyles 8/24/87
(Signature) (Date)

R. Jeffrey Hoyles
(Name)

Contracting Officer
(Title)

DELIVERABLES

HPR

Received 12/02/89 From DOGAMI

3 copies: Geologic Map of the Breitenbush River Area,
Linn and Marion Counties, OR. by Priest, G.P. et al
1987 GMS-46, DOGAMI

Mapping in 83, 84, 85 as an extension of earlier mapping funded by USDOE
during 1979, 1981 field seasons.

3 copies SP. Paper 21: Field Geology of the Northwest Quarter
of the Broken Top 15' Quadrangle, Deschutes Co., Oregon
by E M Taylor

(Funding by US DOE Grant No. DE-FG07-84 ID 12526

NOTICE OF FINANCIAL ASSISTANCE AWARD
(See Instructions on Reverse)

Rec 9/18/86

Under the authority of Public Law 93-410

subject to legislation, regulations and policies applicable to (cite legislative program title):

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE Geothermal Research, Cascade Range		2. INSTRUMENT TYPE <input checked="" type="checkbox"/> GRANT <input type="checkbox"/> COOPERATIVE AGREEMENT	
3. RECIPIENT (Name, address, zip code, area code and telephone no.) State of Oregon Department of Geology & Mineral Industries 1005 State Office Bldg., Portland, OR 97201		4. INSTRUMENT NO. DE-FG07-84ID12526	5. AMENDMENT NO. A002
8. RECIPIENT PROJECT DIRECTOR (Name and telephone No.) George R. Priest (503) 229-5580		6. BUDGET PERIOD FROM 9/1/86 THRU: 8/31/87	7. PROJECT PERIOD FROM 6/25/84 THRU: 7/31/88
9. RECIPIENT BUSINESS OFFICER (Name and telephone No.) John Beaulieu (503) 229-5580		10. TYPE OF AWARD <input type="checkbox"/> NEW <input type="checkbox"/> CONTINUATION <input type="checkbox"/> RENEWAL <input type="checkbox"/> REVISION <input checked="" type="checkbox"/> SUPPLEMENT	
11. DOE PROJECT OFFICER (Name, address, zip code, telephone No.) Susan Prestwich (208) 526-1147 U.S. DOE, Idaho Operations Office 785 DOE Place, Idaho Falls, ID 83402		12. ADMINISTERED FOR DOE BY (Name, address, zip code, telephone No.) Ronald A. King (208) 526-0790 U.S. Department of Energy Idaho Operations Office 785 DOE Place Idaho Falls, ID 83402	

13. RECIPIENT TYPE STATE GOV'T INDIAN TRIBAL GOV'T HOSPITAL FOR PROFIT ORGANIZATION INDIVIDUAL
 LOCAL GOV'T INSTITUTION OF HIGHER EDUCATION OTHER NONPROFIT ORGANIZATION C P SP OTHER (Specify)

14. ACCOUNTING AND APPROPRIATIONS DATA				15. EMPLOYER I.D. NUMBER/SSN
a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number	
89 x 224.91	AM101510	ID-64-91/410		

16. BUDGET AND FUNDING INFORMATION		17. TOTAL ESTIMATED COST OF PROJECT	
a. CURRENT BUDGET PERIOD INFORMATION		b. CUMULATIVE DOE OBLIGATIONS	
(1) DOE Funds Obligated This Action	\$ 49,357.00	(1) This Budget Period	\$ 49,357.00
(2) DOE Funds Authorized for Carry Over	\$ 156,450.00	[Total of lines a. (1) and a. (3)]	
(3) DOE Funds Previously Obligated in this Budget Period	\$ -0-	(2) Prior Budget Periods	\$ 310,000.00
(4) DOE Share of Total Approved Budget	\$ 205,807.00	(3) Project Period to Date	\$ 359,357.00
(5) Recipient Share of Total Approved Budget	\$ -0-	[Total of lines b. (1) and b. (2)]	
(6) Total Approved Budget	\$ 205,807.00		

17. TOTAL ESTIMATED COST OF PROJECT \$ _____
(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations (specify) N/A (Date) _____

c. DOE Assistance Regulations, 10 CFR Part-600, as amended, Subparts A and B (Grants) or C (Cooperative Agreements).

d. Application/proposal dated 3/17/86, as submitted with changes as negotiated

19. REMARKS

This modification revises Part I - Budget Plan, Part II - Conditions, Part III - Statement of Work, and Reporting Requirements.

20. EVIDENCE OF RECIPIENT ACCEPTANCE	21. AWARDED BY
<u>Donald A. Hull</u> 9/5/86 (Signature of Authorized Recipient Official) (Date)	<u>William C. Drake</u> 9/11/86 (Signature) (Date)
Donald A. Hull (Name)	William C. Drake (Name)
State Geologist (Title)	Contracting Officer (Title)

1. Part I - BUDGET PLAN, is revised as attached.
2. Part II - CONDITIONS, Paragraph 5. Project Period, is hereby revised to read as follows:

The project completion date is July 31, 1988, which includes 90 days for completion of the final report. All research effort must be completed by April 30, 1988. Only costs associated with preparation of the final report will be allowed during the 90 days from April 30 to July 31, 1988.

3. Part III - STATEMENT OF WORK, is revised as attached.
4. Part III - REPORT DISTRIBUTION LIST, is revised to delete "Peggy Brookshier, Program Manager, Energy & Technology Division" and insert "Susan Prestwich, Program Manager, Advanced Technology Division."

Grant No.
DE-FG07-84ID12526
Modification #A002

DOGAMI - FY-86

Statement of Work

1.0 Introduction

The work proposed is to study in detail an area adjoining one of the Cascades thermal gradient holes. Both the hole (which is independently drilled) and the DOGAMI study are in support of DOE's Caldera Investigation Program where DOE's intent is to support research of the Cascades volcanic region and to transfer data to the public in order to understand the Cascades resource and stimulate technology development.

2.0 Scope

Task I - Prepare and publish a geologic map of about 15 square miles centered on the drill site at T8S, R8E, NW1/4, SE1/4, Section 28, east half Breitenbush 15' topographic quadrangle. Scale: (1 to 24,000).

Deliverable: Public Geologic Map

Task II - Conduct studies on rocks and available well core to help define mappable lithologic units. All data and analysis will be provided to UURI.

Deliverable: Raw data and analysis provided to UURI.

Task III - Produce comprehensive report containing geologic and geothermal implications and possible geologic models.

All rock analysis data should be published in a retrievable manner.

Deliverable: Final Report - July 31, 1988.

FEDERAL ASSISTANCE BUDGET INFORMATION FORM

FORM EIA-459C
(10/80)

FORM APPROVED
OMB No. 1900-0127

1 DE-FG07-841012526	2 Geothermal Research, Cascade Range
3 Name and Address State of Oregon Department of Geology & Mineral Industries 1005 State Office Bldg., Portland, OR 97201	4 Program/Project Start Date 9/1/86
	5 Completion Date 8/31/87

SECTION A - BUDGET SUMMARY						
Grant Program, Function or Activity (a)	Federal Catalog No (b)	FY-86 Carryover XXXXXX Funds		New or Revised Budget		
		Federal (c)	Non Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. 12526		\$ 156,450	\$	\$ 49,357	\$	\$ 205,807
2.						
3.						
4.						
5 TOTALS		\$ 156,450	\$	\$ 49,357	\$	\$ 205,807

SECTION B - BUDGET CATEGORIES					
6. Object Class Categories	Grant Program, Function or Activity				Total (5)
	FY-86 (1) Carryover	(2)	(3)	(4) Mod A002	
a. Personnel	\$ 42,751	\$	\$	\$ 11,262	\$ 54,013
b. Fringe Benefits	19,836			5,288	25,124
c. Travel	21,489			2,960	24,449
d. Equipment	-0-			-0-	-0-
e. Supplies	4,496			800	5,296
f. Contractual	11,319			10,100	21,419
g. Construction	-0-			-0-	-0-
h. Other	29,400			11,000	40,400
i. Total Direct Charges	129,291			41,410	170,701
j. Indirect Charges	27,159			7,947	35,106
k. TOTALS	\$ 156,450	\$	\$	\$ 49,357	\$ 205,807
7. Program Income	\$	\$	\$	\$	\$

NOTICE OF FINANCIAL ASSISTANCE AWARD
(See Instructions on Reverse)

Peggy Brookshier

Under the authority of Public Law 93-410 and
subject to legislation, regulations and policies applicable to (cite legislative program title):

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE <u>Geothermal Research, Cascade Range</u>		2. INSTRUMENT TYPE <input checked="" type="checkbox"/> GRANT <input type="checkbox"/> COOPERATIVE AGREEMENT	
3. RECIPIENT (Name, address, zip code, area code and telephone no.) State of Oregon Department of Geology and Mineral Industries 1005 State Office Bldg., Portland, OR 97201		4. INSTRUMENT NO. <u>DE-FG07-84ID12526</u>	5. AMENDMENT NO. <u>M001</u>
8. RECIPIENT PROJECT DIRECTOR (Name and telephone No.) George R. Priest (503) 229-5580		6. BUDGET PERIOD FROM <u>9/1/85</u> THRU: <u>9/1/86</u>	7. PROJECT PERIOD FROM: <u>6/25/84</u> THRU: <u>4/30/88</u>
9. RECIPIENT BUSINESS OFFICER (Name and telephone No.) John Beaulieu (503) 229-5580		10. TYPE OF AWARD <input type="checkbox"/> NEW <input type="checkbox"/> CONTINUATION <input type="checkbox"/> RENEWAL <input type="checkbox"/> REVISION <input checked="" type="checkbox"/> SUPPLEMENT	
11. DOE PROJECT OFFICER (Name, address, zip code, telephone No.) <u>Peggy Brookshier</u> (208) 526-1403 U.S. DOE, Idaho Operations Office 785 DOE Place, Idaho Falls, ID 83401		12. ADMINISTERED FOR DOE BY (Name, address, zip code, telephone No.) Ronald A. King (208) 526-0790 U. S. Department of Energy Idaho Operations Office 785 DOE Place, Idaho Falls, ID 83401	

13. RECIPIENT TYPE

<input checked="" type="checkbox"/> STATE GOV'T	<input type="checkbox"/> INDIAN TRIBAL GOV'T	<input type="checkbox"/> HOSPITAL	<input type="checkbox"/> FOR PROFIT ORGANIZATION	<input type="checkbox"/> INDIVIDUAL
<input type="checkbox"/> LOCAL GOV'T	<input type="checkbox"/> INSTITUTION OF HIGHER EDUCATION	<input type="checkbox"/> OTHER NONPROFIT ORGANIZATION	<input type="checkbox"/> C <input type="checkbox"/> P <input type="checkbox"/> SP	<input type="checkbox"/> OTHER (Specify)

14. ACCOUNTING AND APPROPRIATIONS DATA				15. EMPLOYER I.D. NUMBER/SSN
a. Appropriation Symbol	b. B & R Number	c. FT/AFP/OC	d. CFA Number	
<u>89X0224.91</u>	<u>AM1015100</u>	<u>ID-54-91/250</u> 410		

16. BUDGET AND FUNDING INFORMATION	
a. CURRENT BUDGET PERIOD INFORMATION	b. CUMULATIVE DOE OBLIGATIONS
(1) DOE Funds Obligated This Action \$ <u>160,000</u>	(1) This Budget Period \$ <u>160,000</u> [Total of lines a. (1) and a. (3)]
(2) DOE Funds Authorized for Carry Over \$ <u>91,329.45</u>	(2) Prior Budget Periods \$ <u>150,000</u>
(3) DOE Funds Previously Obligated in this Budget Period \$ <u>150,000</u>	(3) Project Period to Date \$ <u>310,000</u> [Total of lines b. (1) and b. (2)]
(4) DOE Share of Total Approved Budget \$ <u>310,000</u>	
(5) Recipient Share of Total Approved Budget \$ <u>-</u>	
(6) Total Approved Budget \$ <u>310,000</u>	

17. TOTAL ESTIMATED COST OF PROJECT \$ 310,000
(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)

18. AWARD/AGREEMENT TERMS AND CONDITIONS

This award/agreement consists of this form plus the following:

a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)

b. Applicable program regulations (specify) N/A (Date) _____

c. DOE Assistance Regulations, 10 CFR Part-600, as amended, Subparts A and B (Grants) or C (Cooperative Agreements).

d. Application/proposal dated 1/3/85, as submitted with changes as negotiated

19. REMARKS
This modification revises Part I - Budget Plan, Part II - Conditions, and Part III - Statement of Work and Reporting Requirements. The DOE Project Officer and Contract Administrator are also changed.

20. EVIDENCE OF RECIPIENT ACCEPTANCE <u><i>Donald A. Hull</i></u> <u>9/26/85</u> (Signature of Authorized Recipient Official) (Date) <u>Donald A. Hull</u> (Name) <u>State Geologist</u> (Title)	21. AWARDED BY <u><i>William C. Drake</i></u> <u>9/24/85</u> (Signature) (Date) <u>William C. Drake</u> (Name) <u>Contracting Officer</u> (Title)
---	--

Budget Summary

<u>Personnel</u>	<u>FY86</u>	<u>FY85 Carryover</u>
Geologist III (2,296 x 15 months)	\$34,440	
Geologist III (2,296 x 4 months)	9,184	
x 1.464 (46.4% O. P. E.)		<u>\$ 63,866</u>
		29,949
 <u>Service and Supplies</u>		
Travel		11,628
Air Fares for Coordination Meetings - Scientific Plan	\$ 3,612	
Out-of-State Travel (meals and lodgin)	4,000	
10 mo. x 20 days/mo x \$42 per diem	8,400	
10 mo. x \$600/mo. average truck expense	6,000	
Analytical Expenses		462
Whole Rock Analyses (115 x \$50/sample)	5,750	
K-Ar Analyses (6 @ \$400/date)	2,400	
Thin Sections (300 @ \$5/section)	1,500	
X-ray Diffraction (100 @ \$19/sample)	1,900	
Direct Samples		
Map Bases and Air Photos	1,500	
Sample Bags, etc.	700	-0-
Equipment	2,388	
Publication		7,993
McKenzie Bridge Quadrangle	10,000	
Cascade Scientific Plan	20,000	
		<u>\$ 68,150</u>
Fringe Benefits	-0-	14,488
Professional Services	-0-	<u>10,895</u>
 <u>Subtotal</u>	 <u>\$132,016</u>	 <u>75,415</u>
 <u>Indirect Costs @ 21.1%</u>	 <u>\$ 27,855</u>	 <u>15,913</u>
 <u>Total</u>	 <u>\$159,871</u>	 <u>91,328</u>

Grant No. DE-FG07-84ID12526
Modification No. M001
Part II - Conditions

Add to Paragraph 18:

"The following property will be acquired under the Grant:
Compac personal computer (2 disk drives, 256K) and Microsoft
Word, version 2.0 with Microsoft Mouse. Prices are as
follows:

Microsoft Word with Mouse	\$ 289.00
Compac Personal Computer	<u>2,099.00</u>
Total	\$2,388.00"

Title of this equipment will be assigned to State of Oregon,
Department of Geology and Mineral Industries upon completion
of the Project.

STATEMENT OF WORK

1.0 SCOPE

The Oregon Department of Geology and Mineral Industries (DOGAMI) will conduct a feasibility study for future Cascades research and will prepare a detailed geologic map of a 15' quadrangle. The feasibility study will be directed toward defining a scientific drilling plan. The geologic mapping will be directed toward determining the geologic association and location of abnormally high heat sources--this information can be used for locating shallow temperature gradient and deeper scientific drill holes. The work will be accomplished according to the following tasks:

- 1.1. Feasibility Study: A study will be conducted to develop a plan for further research, particularly scientific drilling in the Cascade mountains of Washington, Oregon, and California. The drilling plan would focus on deep holes which would penetrate the "rain curtain" effect and provide information on the magmatic and hydrothermal processes. The scientific, industry, and governmental communities will be consulted and coordinated with as a means of accomplishing this task. The finished plan will be printed and distributed to interested persons and organizations.
- 1.2. Geologic Map Preparation: A detailed geologic map of the McKenzie Bridge 15' Quadrangle will be prepared and printed. Considerable field mapping and sample collecting will be integrated with several methods of sample analyses to produce the finished geologic map. The finished map will be printed in color and will be accompanied by the supporting data, including sample locations and sample analyses. A description of the geologic features and an interpretation of the map, especially as related to geothermal potential, will also either be included with the map or as a separate publication.
- 1.3. Project Management and Reporting: This grant is an addition to DE-FG07-84ID12526. The Oregon DOGAMI will continue to provide overall project management and will complete and report on tasks in a timely manner. Management reports shall be provided as defined by the original DOE Form EIA 459A Reporting Requirements Checklist but with modifications so as to include the Feasibility Study and Geologic Map Preparation which tasks are added herein. The required reports are also summarized as follows:

<u>REPORT</u>	<u>DUE</u>
Form DOE 538 Notice of Energy RD&D	30 days after award of addition to grant .
Quarterly Management Summary Report	15 days after calendar quarter end
Project Status Report	15 days after calendar quarter end
Feasibility Study Plan	12-31-85
3 Geologic Maps, as described in 6-25-84 original grant	6-22-86
Final Report (draft)	45 days prior to completion date of this addition to grant
Compilation of Temperature-Depth Data and Heat-Flow Values	On completion date of this addition to grant
1 Geologic Map of McKenzie Bridge 15' Quadrangle	On completion date of this addition to grant
Final Report - to include all work from 6-25-84 to completion date (scheduled for 9-30-87)	On completion date of this addition to grant (scheduled for 9-30-87)

2.0. Deliverables:

The following deliverables will be added to those previously specified under this grant.

Task 1.1. Feasibility Study: The deliverable for this task will be a printed scientific plan for further research, particularly scientific drilling, in the Cascades of Washington, Oregon, and California. The plan will be delivered to U.S. DOE by 12-31-85. The plan will include all information and be presented in a fashion consistent with professional geological practices.

Task 1.2. Geologic Map Preparation: The deliverable for this task will be a colored geologic map of the McKenzie Bridge 15' Quadrangle complete with supporting data, description, and interpretation. Some of the supporting information may be contained in a separate publication. This map will be delivered to U.S. DOE at the end of the contract.

Task 1.3. Project Management and Reporting: Reports described in paragraph 1.3. will be prepared and issued in the amounts and at the frequency shown. The deliverables noted herein (2.0 Deliverables) are also mentioned in paragraph 1.3. along with those due under the original grant which commenced 6-25-84.

**U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE REPORTING CHECKLIST**

FORM EIA-488A
(10/80)

FORM APPROVED
OMB NO. 1900-0127

1. Identification Number: DE-FG07-84ID12526	2. Program/Project Title: Geothermal Research, Cascade Range		
3. Recipient: State of Oregon, Department of Geology & Mineral Industries			
4. Reporting Requirements: PROGRAM/PROJECT MANAGEMENT REPORTING <input type="checkbox"/> Federal Assistance Milestone Plan <input type="checkbox"/> Federal Assistance Budget Information Form <input checked="" type="checkbox"/> Federal Assistance Management Summary Report <input checked="" type="checkbox"/> Federal Assistance Program/Project Status Report <input checked="" type="checkbox"/> Financial Status Report, OMB Form 269 TECHNICAL INFORMATION REPORTING <input checked="" type="checkbox"/> Notice of Energy RD&D <input type="checkbox"/> Technical Progress Report <input checked="" type="checkbox"/> Topical Report <input checked="" type="checkbox"/> Final Technical Report (2)	Frequency	No. of Copies	Addressees
	Q	1,1,1	A,B,C
	Q	1,1,1	A,B,D
	Y,F	1,1	A,C
	Y	1,1	A,E
	A*	1,1,1	A,B,D
	F*	1,1,1	A,B,D
FREQUENCY CODES AND DUE DATES: A - As Necessary; within 5 calendar days after events. F - Final; 90 calendar days after the performance of the effort ends. Q - Quarterly; within 30 days after end of calendar quarter or portion thereof. O - One time after project starts; within 30 days after award. X - Required with proposals or with the application or with significant planning changes. Y - Yearly; 30 days after the end of program year. (Financial Status Reports 90 days). S - Semiannually; within 30 days after end of program fiscal half year.			
5. Special Instructions: Topical Reports will include: Cascades Feasibility Study Geologic Map of McKenzie Bridge Geologic Maps of High Cascades & Western Cascades in the area of Coffin Mountain Geologic Map of Eastern Flanks of High Cascades... *Include one camera-ready copy			
6. Prepared by: (Signature and Date)	7. Reviewed by: (Signature and Date)		

M001

REPORT DISTRIBUTION LIST

DE-FG07-84ID12526

U. S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

- A ATTN: Peggy Brookshier, Program Manager
 Energy & Technology Division
- B ATTN: Ronald A. King
 Contracts Management Division
- C ATTN: E. G. Jones, Director
 Financial Management Division
- D University of Utah Research Institute
 Earth Science Laboratory
 391 Chipeta Way, Suite A
 Salt Lake City, UT 84108
 ATTN: Duncan Foley
- E U. S. Department of Energy
 Technical Information Center
 P.O. Box 62
 Oak Ridge, TN 37830

U.S. DEPARTMENT OF ENERGY
NOTICE OF FINANCIAL ASSISTANCE AWARD
(See Instructions on Reverse)


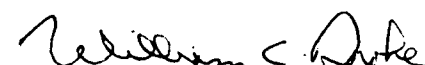
Orig. Grant

93-410

Under the authority of Public Law _____ and

subject to legislation, regulations and policies applicable to (cite legislative program title):

Geothermal Research, Development and Demonstration Act of 1977

1. PROJECT TITLE Geothermal Research, Oregon Cascades				2. INSTRUMENT TYPE <input checked="" type="checkbox"/> GRANT <input type="checkbox"/> COOPERATIVE AGREEMENT	
3. RECIPIENT (Name, address, zip code, area code and telephone no.) State of Oregon Department of Geology & Mineral Industries 1005 State Office Building, Portland, OR 97201				4. INSTRUMENT NO. DE-FG07-84ID12526	
8. RECIPIENT PROJECT DIRECTOR (Name and telephone No.) George R. Priest (503)229-5580				5. AMENDMENT NO.	
9. RECIPIENT BUSINESS OFFICER (Name and telephone No.) John Beaulieu (503)229-5580				6. BUDGET PERIOD FROM: 6/25/84 THRU: 6/25/86	
11. DOE PROJECT OFFICER (Name, address, zip code, telephone No.) R. Eldon Bray, ATD (208)526-0086 U.S. DOE, Idaho Operations Office 550 Second Street, Idaho Falls, Idaho 83401				7. PROJECT PERIOD FROM: 6/25/84 THRU: 6/25/86	
10. TYPE OF AWARD <input checked="" type="checkbox"/> NEW <input type="checkbox"/> CONTINUATION <input type="checkbox"/> RENEWAL <input type="checkbox"/> REVISION <input type="checkbox"/> SUPPLEMENT					
12. ADMINISTERED FOR DOE BY (Name, address, zip code, telephone No.) Elizabeth M. Hyster (208)526-1229 U. S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, ID 83401					
13. RECIPIENT TYPE <input checked="" type="checkbox"/> STATE GOV'T <input type="checkbox"/> INDIAN TRIBAL GOV'T <input type="checkbox"/> HOSPITAL <input type="checkbox"/> FOR PROFIT ORGANIZATION <input type="checkbox"/> INDIVIDUAL <input type="checkbox"/> LOCAL GOV'T <input type="checkbox"/> INSTITUTION OF HIGHER EDUCATION <input type="checkbox"/> OTHER NONPROFIT ORGANIZATION <input type="checkbox"/> C <input type="checkbox"/> P <input type="checkbox"/> SP <input type="checkbox"/> OTHER (Specify)					
14. ACCOUNTING AND APPROPRIATIONS DATA					15. EMPLOYER I.D. NUMBER/SSN
a. Appropriation Symbol		b. B & R Number	c. FT/AFP/OC	d. CFA Number	
89X0224.91		AM1510000	ID-44-91/250		
16. BUDGET AND FUNDING INFORMATION					
a. CURRENT BUDGET PERIOD INFORMATION			b. CUMULATIVE DOE OBLIGATIONS		
(1) DOE Funds Obligated This Action \$ 150,000			(1) This Budget Period \$ 150,000		
(2) DOE Funds Authorized for Carry Over \$ -0-			[Total of lines a. (1) and a. (3)]		
(3) DOE Funds Previously Obligated in this Budget Period \$ -0-			(2) Prior Budget Periods \$ -0-		
(4) DOE Share of Total Approved Budget \$ 150,000			(3) Project Period to Date \$ 150,000		
(5) Recipient Share of Total Approved Budget \$ -0-			[Total of lines b. (1) and b. (2)]		
(6) Total Approved Budget \$ 150,000					
17. TOTAL ESTIMATED COST OF PROJECT \$ _____					
(This is the current estimated cost of the project. It is not a promise to award nor an authorization to expend funds in this amount.)					
18. AWARD/AGREEMENT TERMS AND CONDITIONS					
This award/agreement consists of this form plus the following:					
a. Special terms and conditions (if grant) or schedule, general provisions, special provisions (if cooperative agreement)					
b. Applicable program regulations (specify) N/A (Date) _____					
c. DOE Assistance Regulations, 10 CFR Part-600, as amended, Subparts A and <input checked="" type="checkbox"/> B (Grants) or <input type="checkbox"/> C (Cooperative Agreements).					
d. Application/proposal dated 2/9/84 <input type="checkbox"/> as submitted <input checked="" type="checkbox"/> with changes as negotiated					
19. REMARKS This Grant consists of this NFAA, Part I - Budget Plan, Part II - Conditions and Part III - Statement of Work. The DOE Financial Assistance Rules (10CFR Part 600), OMB Circular A-102, OMB Circular A-87, and ANSI Standard Z 1.8-1971 are incorporated by reference and attached hereto.					
20. EVIDENCE OF RECIPIENT ACCEPTANCE			21. AWARDED BY		
 7/12/84 Signature of Authorized Recipient Official (Date)			 6/26/84 Signature (Date)		
Donald A. Hull (Name)			William C. Drake (Name)		
State Geologist (Title)			Contracting Officer (Title)		

Grantee: State of Oregon, Department of Geology and Mineral Industries

BUDGET PLAN

1. Salaries		\$ 49,221
2. Benefits (OPE)		22,839
3. Travel - Field travel		16,800
Other domestic		3,000
4. Analyses		7,503
5. Supplies		1,500
6. Publications:		
Coffin Mt. Geologic Map		10,000
Map - Area East of Three Sisters		7,000
Open - File Data		1,000
7. Well - Logging		<u>5,000</u>
	SUBTOTAL DIRECT	\$123,863
8. Indirect Costs		<u>26,137</u>
	TOTAL	\$150,000

PART II - CONDITIONS

This grant is subject to the following provisions:

1. General

The grantee is obligated to conduct such project oversight as may be appropriate, to manage the funds with prudence, and to comply with the provisions outlined herein.

2. Reporting Program Technical Performance

- a. Copies. Copies of reports and all other related data and information generated under this grant shall be submitted in accordance with the attached Federal Assistance Reporting Checklist (DOE Form EIA-459A).
- b. Publication of results. The Grantee may publish the results of its work. However, publications and reports prepared under this grant shall contain the following acknowledgment statement, "This (material) was prepared with the support of the U.S. Department of Energy (DOE) Grant No. DE-FG07-84ID12526. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of DOE."
- c. The Federal assistance recipient shall prepare and submit (postage prepaid) the plans and reports indicated on the Federal Assistance Reporting Distribution List. Preparation of the specified plans and reports shall be in accordance with the DOE Order 1332.2. The level of detail the recipient provides in the plans and reports shall be commensurate with the scope and complexity of the task and shall be as delineated in Block 4 - Reporting Requirements - and Block 5 - Special Instructions. The prime recipient shall be responsible for acquiring data from any subcontractors, or subrecipients to ensure that data submitted are compatible with the data elements which prime recipients submit to DOE. Plans and reports submitted in compliance with this provision are in addition to any other reporting requirements of the Federal assistance instrument.
- d. All reports delivered to DOE shall be the sole property of the DOE. The Grantee shall not claim that any report contains any trade secrets or commercial or financial information deemed by the Grantee to be privileged or confidential, or that the Grantee has any proprietary interest in any report.

3. Travel

Domestic travel is an appropriate charge to this grant, and prior authorization for specific trips is not required. Foreign travel must be clearly essential to the grant effort and must, to be charged against this grant, have prior explicit approval of the Grants Officer regardless of its inclusion in the approved grant budget. The Grantee agrees to use U.S. Flag air carriers to the maximum extent practicable when international air transportation becomes necessary under this grant. The difference in cost between first-class air accommodations and economy class accommodations is unallowable.

4. Allowable Costs

Allowability of costs shall be determined in accordance with OMB Circular A-87 which is attached and hereby incorporated by reference.

5. Project Period

The project completion date is June 22, 1986, which includes 90 days for completion of the final report. All research effort must be completed by March 22, 1986. Only costs associated with preparation of the final report will be allowed during the 90 days from March 22, 1986 through June 22, 1986.

6. Payments

- a. The Grantee may request advance payment of cost to be incurred. Such requests should not exceed the expected outlays by the Grantee in the succeeding 30-day period.
- b. Payments to the Grantee shall equal the Federal share of actual allowable costs of performance of this grant, provided however, and notwithstanding any other provision of this grant, that the Government's monetary liability under this grant shall not exceed the Government share of the total approved budget or an amount equal to the Federal share of actual allowable costs, whichever is less. The Grantee shall be obligated to perform under this grant throughout the agreed-upon period of performance, and to bear all costs which DOE has not agreed to pay. However, the Grantee shall have the right to cease to perform when or after the Federal share of actual allowable costs equals or exceeds the Government share of the total approved budget and if prior written notice to that has been provided to DOE.
- c. The Government obligations may be increased unilaterally by DOE by written notice to the Grantee and may be increased or decreased by written agreement of the parties.

6. Payments (Cont'd)

- d. Upon termination or expiration of the total period of performance, the Grantee shall promptly refund to DOE (or make such disposition as DOE may in writing direct) any sums paid by DOE to the Grantee under this grant in excess of the cumulative Government allowable cost incurred in performance under the grant.
- e. Applicable Credits. The Grantee agrees that any refunds, rebates, credits, or other amounts (including any interest thereon) accruing to or received by the Grantee or any assignee under this grant shall be paid by the Grantee to the Government, to the extent that they are properly allocable to costs for which the Grantee has been reimbursed by the Government under this grant. Reasonable expenses incurred by the Grantee for the purpose of securing such refunds, rebates, credits, or other amounts shall be allowable costs hereunder when approved by the Grant Officer.
- f. Audit Adjustments. The Grant Officer may have invoices or vouchers and statements of cost submitted under this grant audited at any time prior to the end of the required retention period for the grant records. Each payment made shall be subject to reduction for amounts included in the related invoice or voucher which are found by the Grant Officer, on the basis of audit, not to constitute allowable cost. If a final audit of costs has not been performed prior to closeout of the grant, DOE or its successor agency, shall have the right to recover an appropriate amount after fully considering the recommendations on disallowed costs resulting from the final audit when conducted.

7. Financial Reporting Requirements

Three copies of the Grantee's Financial Status Report (prepared on an accrual basis) shall be submitted to the Grant Officer at the end of the project period. (The project period of this grant is inclusive of the 90 days stated in OMB Circular A-102, Attachment H.)

8. Retention and Custodial Requirements for Records

Grantees shall retain and permit examination of records as required by OMB Circular A-102, Attachment C.

9. Patent Rights - Short Form

A. Definitions.

(1) "Subject Invention" means any invention or discovery of the Grantee conceived or first actually reduced to practice in the course of or under this Grant, and includes any art, method, process, machine,

9. Patent Rights - Short Form (Cont'd)

manufacture, design, or composition of matter, or any new and useful improvement thereof, or any variety of plants, whether patented or unpatented, under the Patent Laws of the United States of America or any foreign country.

(2) "Patent Counsel" means the DOE Patent Counsel assisting the contracting activity.

B. Invention Disclosures and Reports.

(1) The Grantee shall furnish the Patent Counsel (with notification by Patent Counsel to the Grant Officer):

(i) A written report containing full and complete technical information concerning each Subject Invention within six (6) months after conception or first actual reduction to practice whichever occurs first in the course of or under this Grant, but in any event prior to any on sale, public use, or public disclosure of such invention known to the Grantee. The report shall identify the Grant and inventor and shall be sufficiently complete in technical detail and appropriately illustrated by sketch or diagram to convey to one skilled in the art to which the invention pertains a clear understanding of the nature, purpose, operation, and to the extent known, the physical, chemical, biological, or electrical characteristics of the invention;

(ii) Upon request, but not more than annually, interim reports on a DOE-approved form listing Subject Inventions for that period and certifying that all Subject Inventions have been disclosed or that there were no such inventions; and

(iii) A final report on a DOE-approved form within three (3) months after completion of the Grant work listing all Subject Inventions and certifying that all Subject Inventions have been disclosed or that there were no such inventions.

(2) The Grantee agrees that the Government may duplicate and disclose Subject Invention disclosures and all other reports and papers furnished or required to be furnished pursuant to the Grant.

C. Allocation of Principal Rights.

(1) Assignment to the Government. The Grantee agrees to assign to the Government the entire right, title, and interest throughout the world in and to each Subject Invention, except to the extent that rights are retained by the Grantee under subparagraph C.(2) and paragraph D. of this article.

9. Patent Rights - Short Form (Cont'd)

(2) Greater Rights Determinations. The Grantee, or the employee-inventor with authorization of the Grantee, may request greater rights than the nonexclusive license and the foreign patent rights provided in paragraph D. of this article on identified inventions in accordance with the procedure and criteria of 41 CFR 9-9.109-6. A request for a determination of whether the Grantee or the employee-inventor is entitled to retain such greater rights must be submitted to the Patent Counsel (with notification by Patent Counsel to the Grant Officer) at the time of the first disclosure of the invention pursuant to subparagraph B.(1) of this article or not later than nine (9) months after conception or first actual reduction to practice, whichever occurs first, or such longer period as may be authorized by the Patent Counsel (with notification by Patent Counsel to the Grant Officer) for good cause shown in writing by the Grantee. The information to be submitted for a greater rights determination is specified in 41 CFR 9-9.109-6(e).

D. Minimum Rights to the Grantee. The Grantee reserves a revocable, nonexclusive, paid-up license in each patent application filed in any country on a Subject Invention and any resulting patent in which the Government acquires title. Revocation shall be in accordance with the procedure of subparagraphs C.(2) and (3) of the clause in 41 CFR 9-9.107-5(a). The Grantee also has the right to request foreign rights in accordance with the procedures of subparagraph C.(4) of the clause in 41 CFR 9-9.107-5(a).

E. Employee and Subcontractor Agreements. Unless otherwise authorized in writing by the Grant Officer, the Grantee shall:

(1) Obtain patent agreements to effectuate the provisions of the Patent Rights article from all persons who perform any part of the work under this Grant except nontechnical personnel, such as clerical employees and manual laborers.

(2) Unless otherwise authorized or directed by the Grant Officer, the Grantee shall include the Patent Rights article of 41 CFR 9-9.107-5(a) or 41 CFR 9-9.107-6, as appropriate, modified to identify the parties in any subcontract hereunder having as a purpose the conduct of research.

(3) Promptly notify the Grant Officer in writing upon the award of any subcontract containing a Patent Rights article by identifying the subcontractor, the work to be performed under the subcontract, and the dates of award and estimated completion. Upon the request of the Grant Officer the Grantee shall furnish a copy of the subcontract to such requester.

9. Patent Rights - Short Form (Cont'd)

F. Atomic Energy.

(1) No claim for pecuniary award or compensation under the provisions of the Atomic Energy Act of 1954, as amended, shall be asserted by the Grantee or its employees with respect to any invention or discovery made or conceived in the course of or under this Grant.

(2) Except as otherwise authorized in writing by the Grant Officer, the Grantee will obtain patent agreements to effectuate the provisions of subparagraph F.(1) of this article from all persons who perform any part of the work under this Grant, except nontechnical personnel such as clerical employees and manual laborers.

G. Publication. In order that information concerning scientific or technical developments conceived or first actually reduced to practice in the course of or under the Grant is not prematurely published so as to adversely affect patent interest of DOE, the Grantee agrees to submit to the Patent Counsel for patent review a copy of each paper sixty (60) days prior to its intended publication date. The Grantee may publish such information after expiration of a 60-day period following such submission or prior thereto if specifically approved by Patent Counsel, unless the Grantee is informed in writing within the 60-day period, that in order to protect patentable subject matter, publication must further be delayed. In this event, publication shall be delayed up to one hundred (100) days beyond the 60-day period or such longer period as mutually agreed to.

10. Rights in Technical Data - Short Form

a. Definitions. The definitions of terms set forth in 41 CFR 9-9.201 apply to the extent these terms are used herein.

b. Allocation of Rights.

(1) The Government shall have:

- (i) Unlimited rights in technical data first produced or specifically used in the performance of this grant;
- (ii) The right of the Grant Officer or his representatives to inspect at all reasonable times up to three (3) years after final payment under this grant all technical data first produced or specifically used in the grant (for which inspection the Grantee or its subcontractor shall afford proper facilities to DOE);

10. Rights in Technical Data - Short Form (Cont'd)

(iii) The right to have any technical data first produced or specifically used in the performance of this grant delivered to the Government as the Grant Officer may from time to time direct during the progress of the work or in any event as the Grant Officer shall direct upon completion or termination of this Grant.

(2) The Grantee shall have: The right to use for its private purposes, subject to patent, security or other provisions of this grant, technical data it first produces in the performance of this grant provided the data requirements of this grant have been met as of the date of the private use of such data. The Grantee agrees that to the extent it receives or is given access to proprietary data or other technical, business or financial data in the form of recorded information from DOE or a DOE contractor or subcontractor, the Grantee shall treat such data in accordance with any restrictive legend contained thereon, unless use is specifically authorized by prior written approval of the Grant Officer.

c. Copyrighted Material.

(1) The Grantee agrees to, and does hereby grant to the Government, and to its officers, agents, servants and employees acting within the scope of their duties:

(i) A royalty-free, nonexclusive, irrevocable license to reproduce, translate, publish, use, and dispose of and to authorize others so to do, all copyrightable material first produced or composed in the performance of this grant by the Grantee, its employees or any individual or concern specifically employed or assigned to originate and prepare such material; and

(ii) A license as aforesaid under any and all copyrighted or copyrightable works not first produced or composed by the Grantee in the performance of this grant but which are incorporated in the material furnished under the grant, provided that such license shall be only to the extent the Grantee now has, or prior to completion or final settlement of the grant may acquire, the right to grant such license without becoming liable to pay compensation to others solely because of such grant.

10. Rights in Technical Data - Short Form (Cont'd)

- (2) The Grantee agrees that it will not knowingly include any material copyrighted by others in any written or copyrightable material furnished or delivered under this grant without a license as provided for in subparagraph c.(1)(ii) hereof, or without the consent of the copyright owner, unless it obtains specific written approval of the Grant Officer for the inclusion of such copyrighted material.

11. Authorization and Consent

The Government hereby gives its authorization and consent for all use and manufacture of any invention described in and covered by a patent of the United States in the performance of this grant or any part hereof or any amendment hereto or any grant hereunder (including any lower-tier subcontract).

12. Notice and Assistance Regarding Patent and Copyright Infringement

- a. The Grantee shall report to the Grant Officer, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this grant of which the Grantee has knowledge.
- b. In the event of any claim or suit against the Government on account of any alleged patent or copyright infringement arising out of the performance of this grant or out of the use of any supplies furnished or work or services performed hereunder, the Grantee shall furnish to the Government when requested by the Grant Officer, all evidence and information in possession of the Grantee pertaining to such suit or claim. Such evidence and information shall be furnished at the expense of the Government except where the Grantee has agreed to indemnify the Government.
- c. This clause shall be included in all lower-tier agreements and subcontracts.

13. Reporting of Royalties

If any royalty payments are directly involved in the grant or are reflected in the grant price to the Government, the Grantee agrees to report in writing to the Grant Officer or Patent Counsel during the performance of this grant and prior to its completion or final settlement the amount of any royalties or other payments paid by it directly to others in connection with the performance of this grant together with the names and addresses of licensors to whom such payments are made and either the patent numbers involved or such other information as will permit the identification of the patents or other basis on which the

13. Reporting of Royalties (Cont'd)

royalties are to be paid. The approval of DOE of any individual payments or royalties shall not stop the Government at any time from contesting the enforceability, validity or scope of, or title to, any patent under which a royalty or payments are made.

14. Procurement Standards

Grantee procurements are subject to the requirements of OMB Circular A-102, Attachment O. DOE prior approval is required for all sole source contracts or where only one bid or proposal is received and the aggregate expenditure is expected to exceed \$10,000.

15. Revision of Financial Plans

Any revision to financial plans under this grant are subject to the requirements of OMB Circular A-102, Attachment K and paragraph 600.114 of the DOE Financial Assistance Rules (10 CFR Part 600). DOE approval is required for transfers of amounts budgeted between direct and indirect costs. Among direct cost categories, DOE approval is required when the cumulative amounts of such transfers exceeds or is expected to exceed 5% of the total budget as last approved by DOE. The Grantee shall promptly notify DOE whenever the amount of Federal authorized funds is expected to exceed the needs of the recipient by more than \$5,000 or five percent of the Federal award, whichever is greater. None of the substantive programmatic work may be subcontracted or transferred without the prior approval of DOE.

16. Program Income

Program income is subject to the policy prescribed by OMB Circular A-102, Attachment E and paragraph 600.113 of the DOE Financial Assistance Rules (10 CFR Part 600). Program income other than interest, proceeds from the sale of real and personal property, and royalties shall be treated as specified in 600.113(e)(2)(i). That is they shall be deducted from the total approved budget to determine the net costs on which the DOE costs shall be calculated.

17. Liabilities and Losses

DOE assumes no liability with respect to any damages or loss arising out of any activities undertaken with the financial support of this grant.

18. Property

Property is subject to the requirements of OMB Circular A-102, Attachment N and paragraph 600.117 of the DOE Financial Assistance Rules (10 CFR Part 600). At the end of the project period or at the termination of DOE support for the project, the Grantee shall certify as to any property acquired under this grant.

19. Suspension and Termination

- a. DOE reserves the right to suspend this grant in accordance with the provisions of OMB Circular A-102, Attachment L, paragraph 4 and paragraph 600.122 of the DOE Financial Assistance Rules (10 CFR Part 600).
- b. DOE reserves the right to terminate for cause, in addition to the right to terminate for convenience as provided in OMB Circular A-102, Attachment L, paragraph 5 and paragraph 600.122 of the DOE Financial Assistance Rules (10 CFR Part 600).

20. Quality Assurance

The Grantee will implement a Quality Program in accordance with ANSI Std. Z 1.8-1971 "Specification of General Requirements for a Quality Program" attached, except that paragraphs 3.3.2, 3.3.3, 3.3.4, 3.4, 3.5.2, 3.5.3, 3.6.2, and 3.6.3 are deleted.

STATEMENT OF WORK

1.0 SCOPE

The Grantee will publish two detailed geologic maps covering about 680 square kilometers. One map will be directed to the structural boundary between the High Cascades and the Western Cascades in the vicinity of Coffin Mountain. The second map will examine the eastern flank of the Cascades. A third map of the structural boundary between the High Cascades and the Western Cascades in the area of the North Santiam drainage may also be prepared solely at the Grantee's expense and provided to DOE for information. The Grantee will also continue to update the heat flow data base of the state by temperature logging holes of opportunity. The work will be accomplished according to the following tasks:

- 1.1 Geologic Map Preparation: Two detailed geologic maps covering about 680 square kilometers will be completed. One map will focus on the structural boundary between the High Cascades and Western Cascades in the area of Coffin Mountain. It will be produced at a scale of 1:62,500. The second map will examine the eastern flank of the High Cascades in the vicinity of the Sisters 15 minute quadrangle at a scale of 1:24,000.
- 1.2 Temperature Data Collection: The DOGAMI will continue to update the heat flow data base of the state of Oregon by temperature logging holes of opportunity. David D. Blackwell of Southern Methodist University will calculate heat flow values from temperature logs taken by DOGAMI staff.
- 1.3 Project Management and Reporting: Provide overall project management and complete and report on tasks in a timely manner. Management reports shall be provided as defined by the attached DOE Form EIA 459A Reporting Requirements Checklist. The required reports are also summarized as follows:

	<u>DUE</u>
Form DOE 538 Notice of Energy RD&D	30 days after award of grant
Quarterly Management Summary Report	15 days after calendar quarter end
Project Status Report	15 days after calendar quarter end

DUE

Final Report
(Draft)

Due 45 days prior to
completion date

Final Report

Due on completion date

Financial Status Report,
OMB Form 269

Due at the end of each program year

2.0 DELIVERABLES:

The following deliverables will be made as a result of this activity.

Task 1.1 Geologic Map Preparation: The deliverables for this task will be two geologic maps at the 1:62,500 scale and one map at the 1:24,000 scale. The maps will be delivered to USDOE at the end of the contract period. Results of geochemical analyses, age dates, and thin-section studies will be made available to DOE and to the public through DOGAMI publication procedures.

Task 1.2 Temperature Data Collection: The deliverable will be a compilation of the temperature-depth data and heat flow values which will be delivered to USDOE at the end of the contract, and made available to the public through DOGAMI publications procedures.

Task 1.3 Project Management and Reporting: Reports previously described in paragraph 1.3 will be prepared and issued in the amounts and at the frequency shown. The final report shall be a brief summary of program activities, information obtained, lessons learned, and any recommendations.

**U.S. DEPARTMENT OF ENERGY
FEDERAL ASSISTANCE REPORTING CHECKLIST**

FORM EIA-485A
(10-88)

FORM APPROVED
OMB NO. 1988-0127

1. Identification Number: DE-FG07-84ID12526	2. Program/Project Title: Geothermal Research, Oregon Cascades		
3. Recipient: State of Oregon, Department of Geology and Mineral Industries			
4. Reporting Requirements:	Frequency	No. of Copies	Addressees
PROGRAM/PROJECT MANAGEMENT REPORTING			
<input type="checkbox"/> Federal Assistance Milestone Plan			
<input type="checkbox"/> Federal Assistance Budget Information Form			
<input checked="" type="checkbox"/> Federal Assistance Management Summary Report	Q		
<input checked="" type="checkbox"/> Federal Assistance Program/Project Status Report	Q		
<input checked="" type="checkbox"/> Financial Status Report, OMB Form 269	Y		
TECHNICAL INFORMATION REPORTING			
<input checked="" type="checkbox"/> Notice of Energy RD&D	O		
<input type="checkbox"/> Technical Progress Report			
<input checked="" type="checkbox"/> Topical Report	A		
<input checked="" type="checkbox"/> Final Technical Report	F		
<p>FREQUENCY CODES AND DUE DATES:</p> <p>A - As Necessary; within 5 calendar days after events. F - Final; due at end of project period. Q - Quarterly; within 15 days after end of calendar quarter. O - One time after project starts; within 30 days after award. X - Required with proposals or with the application or with significant planning changes. Y - Yearly; at the end of program year. S - Semiannually; within 30 days after end of program fiscal half year.</p>			
5. Special Instructions:			
6. Prepared by: (Signature and Date)		7. Reviewed by: (Signature and Date)	



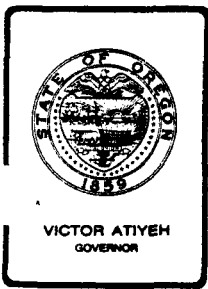
U.S. DEPARTMENT OF ENERGY
IDAHO OPERATIONS OFFICE
REPORT DISTRIBUTION LIST

DE-FG07-84ID12526

Federal Assurance Management Summary Report
Federal Assurance Budget Information Form
Federal Assurance Milestone Plan
Federal Assurance Program
Federal Assurance Program Status Report
Federal Assurance Program Summary Report
Federal Assurance Program OMB Form 269
Federal Assurance Program Report
Federal Assurance Program Report
Federal Assurance Program Report

Addressees	Number of Report Copies																																	
U. S. Department of Energy Idaho Operations Office 550 Second Street Idaho Falls, ID 83401 Attn: R. Eldon Bray, Program Mgr. Energy & Technology Division Attn: Elizabeth M. Hyster Contracts Management Div. Attn: E. G. Jones, Director Financial Management Div.													2	2										8	8									
U. S. Department of Energy Forrestal Bldg., CE-324 1000 Independence Ave, S.W. Washington, DC 20585 Attn: Ron Toms													1	1										6	6									
University of Utah Research Institute Earth Science Laboratory 391 Chipeta Way, Suite C Salt Lake City, UT 84108 Attn: Duncan Foley													1	1										1	1									
U. S. Department of Energy Technical Information Center P. O. Box 62 Oak Ridge, TN 37830																																		1

Special Instructions



Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

February 9, 1984

Eldon Bray
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Dear Eldon:

Enclosed is a grant proposal outlining two tasks which we feel will be highly useful to the high-temperature geothermal assessment program in Oregon. The proposed geologic mapping tasks will cover some areas which are of critical interest to developers in the central Cascades. This proposal will also support our ability to respond to the public for temperature logging services.

The proposal is designed around a total budget of \$260,000, \$110,000 of which is a cost share by the Department, primarily for my supervisory and field time and for publication costs for one of the 15' quadrangles which I will be mapping. The balance of \$150,000 is the amount listed as USDOE support in an announcement from Mark Hatfield's office. This is, in our opinion, insufficient for a meaningful drilling program, although such a program is critically important to the assessment. We will approach USDOE in the future for support for a program to fill in gaps in the heat flow data base for the High Cascades and the southern part of the Western Cascade Range. In the meantime, the enclosed proposal will help to fill some important data gaps and will keep our program alive for the next two years.

Please feel free to contact me if you have any questions, or if you require more refinement of task descriptions and deliverables. We are very pleased that we will continue to be able to work with you and your staff.

Sincerely,

George R. Priest
Geothermal Specialist

RECEIVED

FEB 15 1984

km

Enclosure

ADVANCED TECHNOLOGY
BRANCH



Department of Geology and Mineral Industries

ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

April 14, 1987

Susan Prestwitch
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

Dear Susan:

As you may know, Oregon is in the process of responding to the request for proposals for the SSC. Our Department has been called in to participate in this effort during the 1987 field season. We see no window of time available to fit in the proposed work on the Thermal Power site (reference: Grant No. DE-FG07-84ID12526, Mod. #A002, statement of work, Tasks I, II, and III).

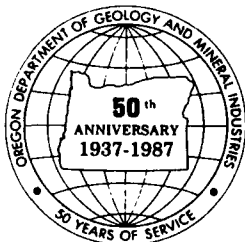
We ask that the due date for deliverables from the above tasks be changed from July 31, 1988 to July 31, 1989. This no-cost, one-year extension will allow us to conduct the field work in the summer of 1988 instead of this summer.

Sincerely,

George R. Priest
Regional Geologist

GRP:rm

cc: Ron King
Don Hull
John Beaulieu
✓ Howard Ross



UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108-1295
TELEPHONE 801-524-3422

M E M O R A N D U M

TO: Peggy A. M. Brookshier
Susan M. Prestwich
Trudy A. Thorne

FROM: Howard P. Ross

SUBJECT: Comments regarding September 11, 1987 letter by Dr.
Donald A. Hull, DOGAMI, to Trudy A. Thorne

As a member of the Technical Evaluation Panel for PRDA No. DE-PR07-87ID12662 I offer the following comments regarding the subject letter, and the earlier request to delete the drilling task from the DOGAMI proposal. Dr. Hull discusses two concerns expressed by the TEP.

1) Inability to meet the proposed schedule. The "small" Cascade project currently funded now totals \$359,357 in total funding-substantially more than requested in the proposal to the 1987 PRDA. The schedule for completion of the existing Grant was 4/30/88 after amendment no. M001, and was later modified to 7/31/88 after amendment no. M002. A later request for a no cost time extension to 7/31/89 was denied by DOE. The completion of the Feasibility Study Plan for Cascade Drilling was established as 12/31/85 by Mod. M001, then extended to 9/11/86 by Mod. M002. The study plan was received by DOE in August 1987.

The Oregon work on another DOE program, a proposal for the Supercollider (SSC) project, was not a funded DOE project, but rather a state sponsored effort which was given priority over an existing grant.

The overall goal of a crustal transect across the Cascade Range through Santiam Pass in Oregon is a priority established by DOGAMI, not a solicited and acknowledged DOE priority.

2) Concern about the hole depth being too shallow to obtain a useful temperature gradient. Table 1 of the subject letter does present some new encouragement that a 650 m drill hole would yield a meaningful conductive geothermal gradient. Nevertheless, Blackwell and Steele (1987, GRC) show that strong intrahole water flows preclude a satisfactory determination of the "conductive"

geothermal gradient for Geo Operator holes N-1 and N-3 above depths of 1150 and 1200 m respectively, and that an average gradient can only be established using data from these depths (see attached Figure 2 from DOGAMI proposal). The geothermal gradient in the CTGH-1 hole changes to a substantially lower value at a depth of approximately 650 m. In addition, drill hole LI-4, eight miles southwest of Santiam Pass, recorded a maximum temperature of 25 degrees C for a maximum depth of 557 m (Geothermal Resources Map of Oregon, 1982).

The Technical Evaluation Panel still believes that there is a reasonably large risk that a geothermal gradient for the proposed 650 m drill hole would not be a meaningful value.

Two other factors resulted in a low ranking for this proposal, using the uniform guidelines established for the proposal evaluations. DOGAMI does not appear to be adequately staffed at present to undertake this work. Most of the staff, including a senior geologist and a drill site geologist, must be hired for the proposed project. Geophysical work for the project would be delegated to a subcontractor. Thus most of the staff required for the project is not currently in house at DOGAMI.

The primary product from the proposed work would be the temperature profile, heat flow and related data from a single drill hole. If the temperature profile is disturbed or otherwise nonrepresentative, the deliverable would have limited technical value, even though the proposed work had required a large portion of the funding available to the entire PRDA.

While the DOE/GTD is deeply interested in the geothermal potential of the Cascades, and hence of the proposed PSDC Santiam Pass drilling transect, funding within the State Cooperative Program is limited and is oriented toward more specific resource assessment projects. A project the magnitude of the PSDC is better addressed by other funding agencies.


Howard P. ROSS

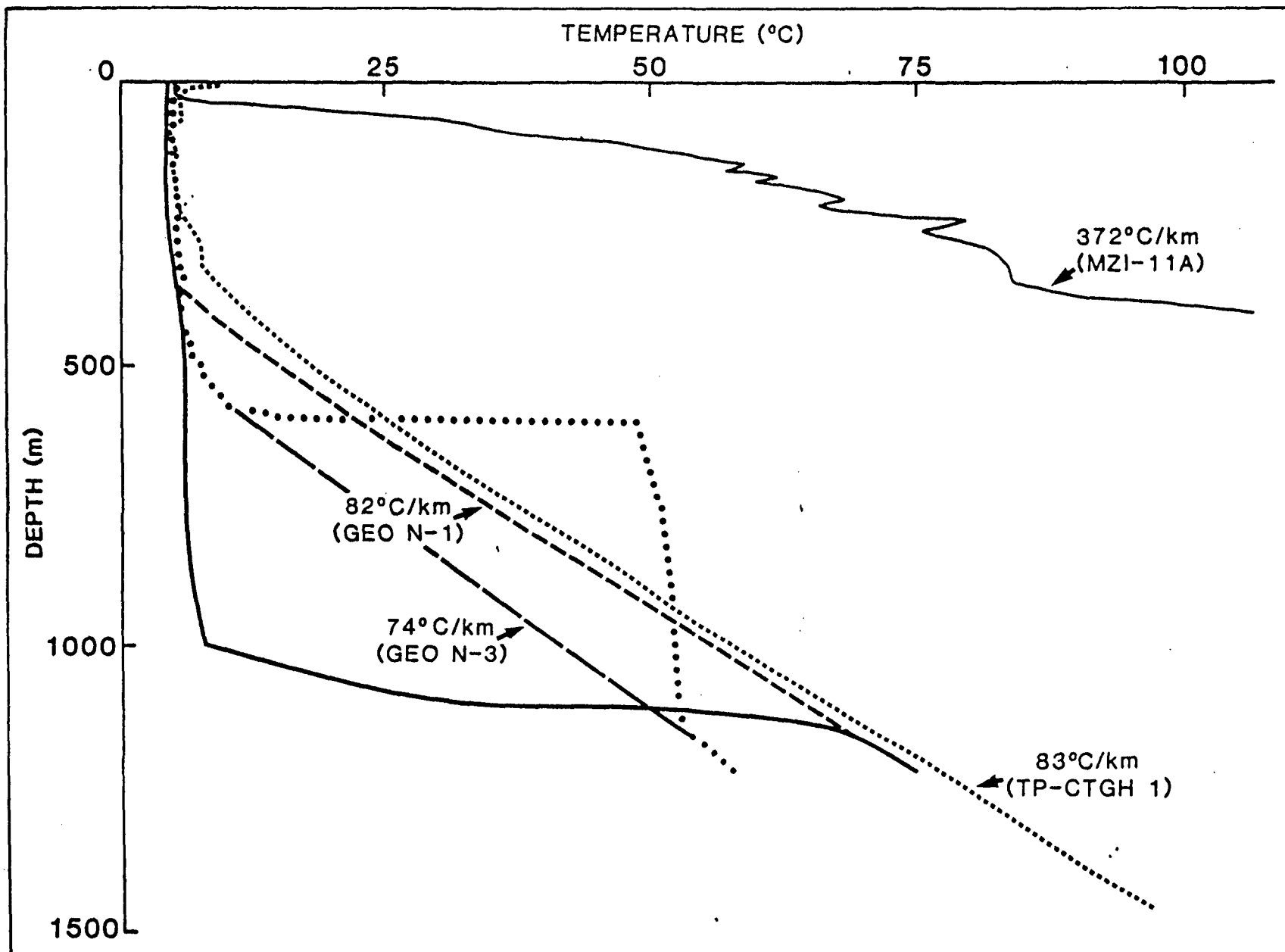


Figure 2. Temperature-depth curves of holes from the USDOE Cascade Deep Thermal Gradient Drilling Program. Dashed lines show the temperature-depth curves as they would be were they not affected by inferred intra-borehole fluid circulation. Inferred temperature gradients are shown in degrees Centigrade per kilometer. Temperature data in hole MZI-11A were taken only 20 hours after circulation of drilling fluids, so hole temperatures had probably not completely stabilized. Temperatures for MZI-11A were measured by Al Waibel of Columbia Geoscience; other measurements are by David D. Blackwell of Southern Methodist University. See Figure 1 for locations.



1 copy For Info
9/11/87

Department of Geology and Mineral Industries

ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

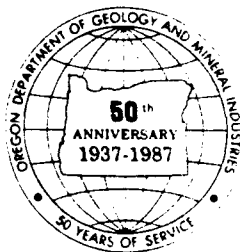
September 11, 1987

Trudy A. Thorne
Contracts Management Division
U.S. Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

Dear Ms. Thorne:

Thank you for your letter dated September 8, 1987, concerning our proposal in response to PRDA No. DE-PR07-87ID12662. I would like to offer some clarifications and, more importantly, some new information which may be pertinent regarding your department's final decision. My understanding from conversations with USDOE staff and from your letter is that there are two major concerns which prompted your department to ask for elimination of the drilling task from the proposal. These concerns are (1) that we would not be able to meet the proposed schedule (i.e. your reference to our "past record"), and (2) that the proposed depth of the drill hole is too shallow to obtain a reliable temperature gradient.

The first concern may have arisen as a result of our request for a no-cost time extension on a small Cascade project currently funded through your office. That request was the result of a short term scheduling conflict which arose as result of Oregon's work on another DOE program, submission of a proposal for the Supercollider (SSC) project. The Scheduling difficulty arose because of the need to do the field work for the small Cascade project at the same time as the SSC project. We made the decision to do the SSC work partly because one of the proposed SSC sites is in the east-west transect proposed for mapping in our Program for Scientific Drilling in the Cascades (PSDC). The SSC work, was an opportunity for us to continue working toward our overall goal of completing a crustal transect across the the entire Cascade Range at the latitude of Santiam Pass. It is noteworthy that the SSC project was fully funded by the State at a cost in excess of one million dollars and resulted in numerous drill holes. In any case, the SSC work is now done, so there will be no more conflicts from that project. Should the current proposal be funded, there would be ample support to provide staff to accomplish all tasks, regardless of other projects. We have worked for over three years to get this drilling project started and will give it the highest priority.



Trudy A. Thorne
September 11, 1987
Page 2

The second concern, that the proposed hole is too shallow to obtain a useful temperature gradient, is easily refuted. Our review of publicly available data has revealed that nearly every hole drilled to 600-650 m in the High Cascades or in similar terrain at Newberry Volcano has encountered a usable gradient in the lower part of the hole. The enclosed table summarizes these holes in the central Oregon area. Two holes did not encounter conductive gradients until about 550 m, but these holes have collar elevations of 5720 ft. and 5850 ft. Santiam Pass itself is just above 4800 ft elevation. We conducted a preliminary field analysis of possible drill sites in July and found two excellent candidate sites near Santiam Pass which are at elevations of 3500-3600 feet. The Thermal Power drill hole in the Clackamas River area is the closest to this elevation. It acquired a conductive gradient below about 220 meters. We would then expect that about 430 m of a 650 m hole would have a usable gradient.

In spite of this evidence, there is always the possibility that unique hydrologic conditions at any site will affect the conductive temperature profile. Clearly, a deeper hole on the order of 1.2 km would be preferred in order to enhance the chances for an accurate heat flow measurement. We therefore proposed in our drilling plan that the hole be cased to 152 m to ensure that it could be deepened to 1.2 km+.

In the interim, the USDOE Office of Basic Energy Sciences has shown interest in deepening the hole, should the PSDC group submit a competitive proposal. We are now preparing this proposal and will mail it next week. This new proposal will support (1) drilling the hole from 650 m to at least 1.2 km, and (2) doing extensive scientific studies, including geophysical surveys, vertical seismic profiling, in situ stress tests, paleomagnetic measurements, and igneous and metamorphic petrologic studies.

Drilling of this hole to 1.2 km would thus be the first step toward the accomplishment of the highest priority objective of Phase I of the PSDC, namely drilling four 1.2 km holes in an east-west pattern across the Santiam Pass area. I can think of few geothermal assessment opportunities which compare with a chance to obtain the first measurements of heat flow on the axis of volcanism in the only active volcanic arc in the conterminous U.S.

Trudy A. Thorne
September 11, 1987
Page 3

Clearly, our proposal to USDOE-BES assumes that your office will support the initial drilling to 650 m. Without your support the chances of obtaining support from USDOE-BES will be seriously diminished.

Our association with your office has produced a wealth of valuable data and publications on the geothermal potential of the state. I enclose for your review the list of geothermal publications produced by our cooperative efforts with your agency over the last 10 years. I would also comment that our "past record" in geothermal research is something that our agency points to with pride. Our hope is that we can continue to pursue cooperative projects with you.

We would be glad to meet with you and your advisory committee to discuss this proposal and respond directly to any further concerns you may have. A meeting next week would be most appropriate in view of the deadlines for final response to your letter and to the opportunity with USDOE-BES.

Sincerely,



Donald A. Hull
State Geologist

CC H. Brent Clark
Marshall Reed
George R. Priest
John D. Beaulieu

TABLE 1

COMPANY	HOLE NAME	LOCATION	COLLAR ELEVATION (ft)	DEPTH AT WHICH GRADIENT IS CONDUCTIVE (m)
EWEB	Fish Lake Creek	13S/7E-32	3135	50
EWEB	Twin Meadows	12S/7E-9	3920	225
EWEB	SISI Batte	8S/8E-6	2800	140
Geo Operator	N-3	20S/12E-24	5720	550 ✓
Geo Operator	N-1	22S/12E-25	5850	550 ✓
Thermal Power	CTGH-1	8S/8E-28	3800	220
Cal Energy	MZI-11A	31S/7½E-15	6050	10 (?)



Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

910 STATE OFFICE BLDG., 1400 SW 5th AVE., PORTLAND, OR 97201-5528 PHONE (503) 229-5580

August 22, 1986

Ronald King
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, ID 83401

Dear Ron:

As you know from our quarterly and annual reports, we are somewhat behind schedule on completion of the final printed copies of the three geologic maps and the science plan listed as deliverables in Grant No. DE-FG07-84 ID 12526 (Task 1.1 - original grant; Task 1.1 - Modification No. M001). The delivery dates on these tasks are past. The printed products have been delayed by the review process and some unforeseen factors. This is particularly true of the science plan. This document, because of the the number of contributors, has required extensive coordination and review -- a process which is still going on.

It may be simpler if all deliverables are due at the end of the grant period, which is April 30, 1988. We will, of course, have a number of the printed products available prior to that (e.g. the final product for Task 1.2 of the original grant is available now). However, it will be simpler for all concerned if we send all of the printed copies at one time at the end of the contract.

We herein request a no-cost time extension for the deliverables on Task 1.1 (original grant) and Task 1.1 (Modification M001) to April 30, 1988. If you need information copies of any of the maps or reports prior to that time, we will be glad to provide them. Preliminary copies (hand lettered maps + typed texts) of most of the products are available now.

*Will extend deliverable
date request to 8/1/87*

*Emp
9/2/86*

Sincerely,

George R. Priest

George R. Priest
Regional Geologist

cc, Susan Prestwitch
Peggy Brookshire
John Beaulieu

Grant No.
DE-FG07-84ID12526
Modification #A002

DOGAMI - FY-86

Statement of Work

1.0 Introduction

The work proposed is to study in detail an area adjoining one of the Cascades thermal gradient holes. Both the hole (which is independently drilled) and the DOGAMI study are in support of DOE's Caldera Investigation Program where DOE's intent is to support research of the Cascades volcanic region and to transfer data to the public in order to understand the Cascades resource and stimulate technology development.

2.0 Scope

Task I - Prepare and publish a geologic map of about 15 square miles centered on the drill site at T8S, R8E, NW1/4, SE1/4, Section 28, east half Brutembush 15' topographic quadrangle.

Deliverable: Public Geologic Map

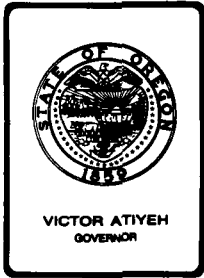
Task II - Conduct studies on rocks and available well core to help define mappable lithologic units. All data and analysis will be provided to UURI.

Deliverable: Raw data and analysis provided to UURI

Task III - Produce comprehensive report containing geologic and geothermal implications and possible geologic models.

All rock analysis data should be published in a retrievable manner.

Deliverable: Final Report - August 31, 1987



Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

March 17, 1986

Susan Prestwitch
U.S. Department of Energy
Idaho Operations Office
550 Second St.
Idaho Falls, Idaho 83401

Dear Susan:

Enclosed is a proposal for \$53,494 to do geological research and data synthesis on the Thermal Power well to be drilled in the northern Oregon Cascades this summer. I tried to trim as much out of the budget as possible, including obtaining free K-Ar dates and reducing the scope of the study, but it still came out over \$50,000.

The main problem is the alteration study. I thought Terry Keith was going to do the study with USGS or USDOE funding when I had preliminary discussions with Marshall Reed. Her supervisor apparently will not allow her to work on it, so we wrote in about \$5,000 for some alteration work. This minimal amount will only be enough to fund some work through a university where the study can be heavily subsidized by the university support system.

I hope there is enough slack in your budget for the small increase we are asking beyond the \$50,000. What is really needed to do the work which should be done is a total budget of about \$75,000, as I mentioned in a recent conversation with Marshall.

Best regards,

George R. Priest
Geothermal Specialist

cc Marshall Reed

RECEIVED

MAR 19 1986

**ADVANCED TECHNOLOGY
BRANCH**

UNSOLICITED RESEARCH PROPOSAL
SUBMITTED TO DIVISION OF GEOTHERMAL ENERGY
U.S. DEPARTMENT OF ENERGY

Title

GEOTHERMAL RESEARCH, OREGON CASCADES
GEOLOGIC AND GEOTHERMAL STUDIES OF THE THERMAL POWER DRILL SITE

By

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
910 State Office Building
Portland, Oregon 97201

Amount Requested: \$53,494

Begin: June 1, 1986

End: April 30, 1988

ENDORSEMENTS

Principal Investigator

George R. Priest 3-17-86
George R. Priest, Geothermal Specialist

Approving Administrative Official

Donald A. Hull 3/17/86
Donald A. Hull, State Geologist

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INDIRECT COST CALCULATIONS BASED ON 1985-87 BUDGET.....	22
O.P.E. (OTHER PAYROLL EXPENSE).....	23

INTRODUCTION

This proposal is aimed at providing scientific analysis of geologic data from a 5,000 ft. well to be drilled by Thermal Power Company under SCAP Number DE-SC07-85ID12580 for Cascades deep thermal gradient drilling. The proposed work is related to work in progress for USDOE Grant No. DE-FG07-84 ID 12526, Task 1.1, Geologic Map Preparation. Geologic maps encompassing about 400 square miles of the High Cascade-Western Cascade boundary zone have recently been completed with partial support from USDOE. The Thermal Power drill site is located adjacent to this geologic mapping (Figure 1). Work proposed here will allow correlation of rock units and structures from these map areas to the Thermal Power drill site. Coordination with other scientific groups working on the site will result in development of a comprehensive model of the geothermal system.

Support is sought for three tasks: 1) production of a detailed geologic map of the area immediately adjacent to the drill site, 2) analysis and correlation of the subsurface stratigraphy from cuttings and logs, and 3) development of geothermal models utilizing data from tasks 1 and 2 and from scientific groups working on heat flow, other geophysics, and fluid chemistry.

A preliminary geothermal model (Figure 2) has been developed from geologic and temperature gradient data for the Breitenbush

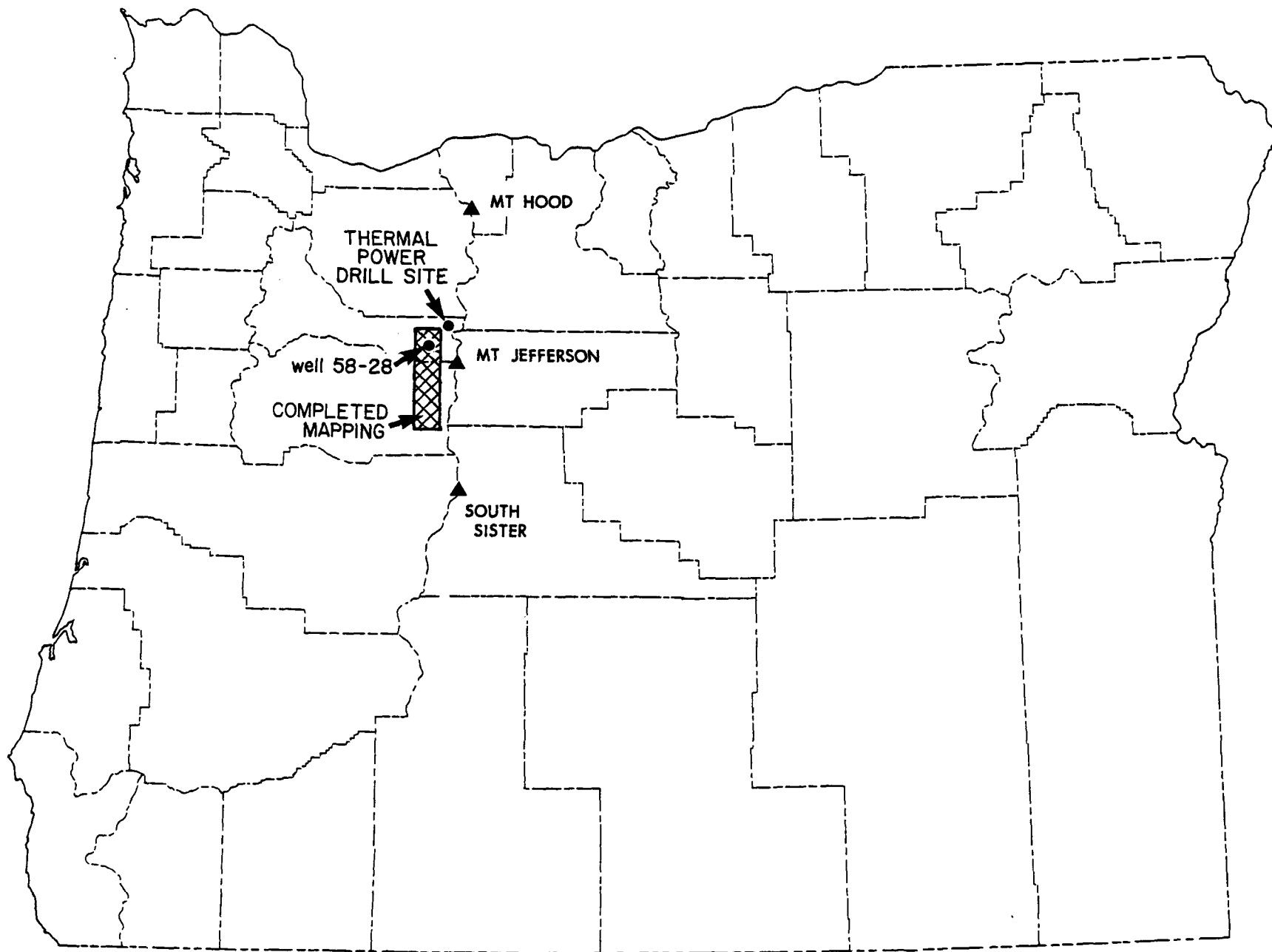


Figure 1. Index map showing the location of the Sunedco Well No. 58-28, the Thermal Power drill site, and geologic mapping completed by DOGAMI staff during 1984-1985.

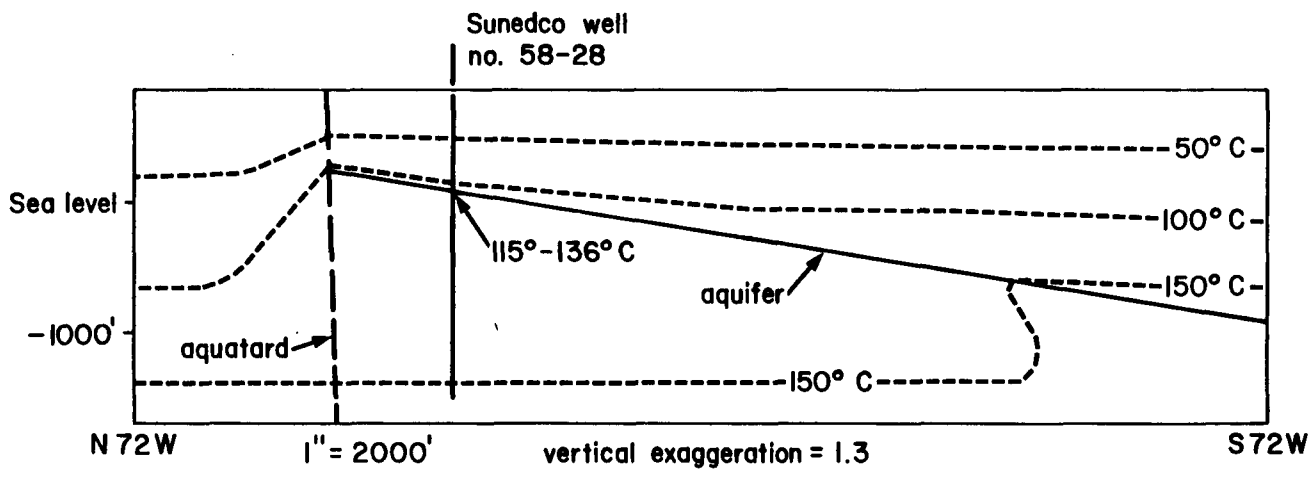


Figure 2. Possible thermal model for the Breitenbush hydrothermal system based on temperature gradient and geologic data from the area. The stratigraphic horizon which contains the aquifer encountered in the Sunedco Well 58-28 dips toward the Thermal Power drill site. The aquifer had a temperature of 115°C to 136°C in various temperature measurements at 2,600' depth in Well 58-28.

Hot Springs geothermal system, which is located a few miles southwest of the Thermal Power drill site (see Well No. 58-28, Figure 1 for approximate location of the hot springs). The model proposes that the thermal water may be contained in a specific stratigraphic unit dipping to the southeast under the High Cascade Range. Projections of the stratigraphy from the Breitenbush area to the Thermal Power site suggest that this same stratigraphic horizon may occur at the Thermal Power drill site. Chemical and isotopic data on the cuttings and fluids in the Thermal Power well and on other wells drilled in the area will allow testing of this hypothesis. If proven, then a predictive model could be developed for the entire geothermal system between Breitenbush Hot Springs and the Thermal Power site. Particular emphasis will be placed on correlating lithologies between the Thermal Power well and the Sunedco Well No. 58-28, drilled to 8,080' near Breitenbush Hot Springs (Figure 1).

ORGANIZATION AND MANAGEMENT PLAN

The Department of Geology and Mineral Industries is responsible under Oregon state law for the conduct of geologic research and the regulation for the exploration and development of minerals and mineral fuels including geothermal energy. DOGAMI and its predecessor organization have been in existence since 1913. The agency has a staff of twelve geologists and engineers; a chemical, assay and spectrographic laboratory; library; cartographic facilities; and an editorial accounting staff. These facilities will be available to the project described in this proposal at no additional cost.

DOGAMI has been engaged in continuing geothermal research, involving a variety of geological, geochemical and geophysical studies, for the past seventeen years. The results of these efforts are included in the attached geothermal publications list.

The principal investigator is Dr. George R. Priest, Geothermal Specialist, DOGAMI. Dr. Priest recently completed heat flow and geologic studies in the northern Cascades of Oregon and supervised ongoing research into assessment of various areas of eastern Oregon for direct-use geothermal resources. The latter study included geologic, heat flow, and geochemical investigations. Prior to coming to DOGAMI, Dr. Priest worked for the Geothermal Division of Chevron Resources Company. While with Chevron, he completed all of the detailed geologic mapping for

the Beowawe KGRA, Nevada. Prior to working in geothermal energy Dr. Priest conducted research in volcanic petrology and managed mineral exploration programs in industry.

The management structure for the research program is presented in Figure 3. Dr. Priest (Geologist IV) will supervise the project with the help of a senior geologist (Geologist III).

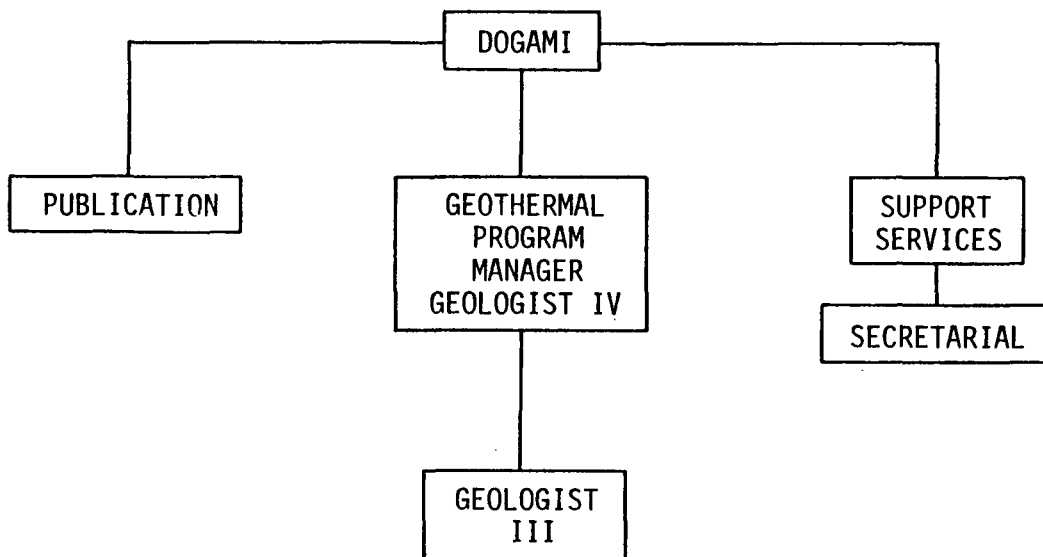


Figure 3. Organization chart.

TASK DESCRIPTIONS

It is proposed that these tasks be added to existing Grant No. DE-FG07-84ID12526/

TASK I - GEOLOGIC MAPPING OF THE THERMAL POWER DRILL SITE

Preparation and publication of a 1:24,000-scale geologic map of about 15 square miles centered on the drill site at T8S, R8E, NW1/4, SE1/4, Section 28 in the east half of the Breitenbush 15' topographic quadrangle.

TASK II - CORRELATION OF ROCK UNITS AND ANALYSIS OF ALTERATION

Chemical and mineralogic analysis of surface and subsurface rocks will be used to define mappable units. Radiometric dating of selected samples will be necessary for correlation and for determination of the age of volcanic heat sources. Rock samples from outcrops and wells in adjacent areas will be utilized to establish regional correlations. Particular emphasis will be placed on establishing correlations to the 8,080 ft. Sunedco Energy and Development Well No. 58-28.

The hydrothermal alteration mineralogy will be studied to determine the thermal history of the Thermal Power well and adjacent wells. X-ray diffraction spectrometry, petrography, and

fluid inclusion heating experiments will be the chief methods for this part of the study.

TASK III - SYNTHESIS OF DATA

A comprehensive report on the geologic and geothermal implications of the study will be produced. The report will present possible geothermal models which are consistent with the data produced in this study and from parallel studies of the fluids and geophysical properties of the area, including heat flow.

DELIVERABLES

All data will be summarized in an open-file report published through DOGAMI. A black and white geologic map of about 15 square miles of the study area at a scale of 1:24,000 will be included in the report.

DUE DATE FOR DELIVERABLE

Open-file report: 4-30-88 (end of Grant No. DE-FG07-84ID12526)

PATENT INFORMATION

There is no proprietary information included in this proposal, and the information to be collected during the proposed study will not be confidential.

APPLICATIONS TO OTHER SPONSORS

This proposal has not been submitted to other potential sponsors, and we do not plan to submit it to others in the future.

GEORGE R. PRIEST
10710 Southwest Ponderosa Place
Tigard, Oregon 97223
(503) 229-5580

EDUCATION

Academic:

B.S., Geology, Oregon State University, Corvallis, Oregon, 1971
M.S., Geology, University of Nevada, Reno, Nevada, 1974
Ph.D., Geology, Oregon State University, Corvallis, Oregon, 1979

Professional:

- o Technical Training Course No. 7, Introduction to Geothermal Log Interpretation, April 1981. Sponsor - GRC.
- o Short Course, Geothermal Potential of the Cascade Mountain Range, May 1981. Sponsor - GRC. WSEO, ODOE.

PROFESSIONAL EXPERIENCE

Geologist 4, Geothermal Specialist, Oregon Department of Geology and Mineral Industries, 11-1-80 to present (Dr. Donald A. Hull, supervisor).

Geologist 3, Oregon Department of Geology and Mineral Industries, 1005 State Office Building, Portland, Oregon 97201, 9-3-79 to 10-31-80 (Dr. Joseph Riccio, supervisor).

Geothermal Exploration Geologist, Chevron Resources Company, P.O. Box 3722, San Francisco, California 94119, 6-20-79 to 9-15-79 (Jim Salveson, supervisor).

Consulting Geologist, to Hanna Mining Company, Coastal Mining Division, 388 W. 2550 S., Salt Lake City, Utah 84115, 3-20-78 to 3-23-78; 3-27-78 (Wade Hodges, supervisor).

Geochemist, Lawrence Livermore Laboratory, P.O. Box 808, Livermore, California 94550, 7-5-77 to 9-7-77 (Dr. Kevin K. Knauss and Dr. Terry L. Steinborn, supervisors).

Exploration Geologist, Cyprus Mines Corporation, S. 400 Jefferson Street, Suite 161, Spokane, Washington 99204, 7-25-74 to 9-15-75 (Dr. E.A. Schmidt, supervisor).

Consulting Geologist; to Mr. Bruce Miller, consulting exploration geologist, Geology Department, University of Nevada, Reno, Nevada 89502, 7-1-74 to 7-6-74.

Consulting Geologist, Project Manager, for Dr. D.B. Slemmons, Geology Department, University of Nevada, Reno, Nevada 89502, 11-73 to 3-74.

Engineering Geologist, Woodward-Clyde and Associates, Berkeley, California; 5 days 1-74 (Alfred Ringa, supervisor).

Exploration Geologist, Phelps Dodge Corporation, Reno, Nevada 89502, 6-15-72 to 9-15-72 (Robert Ludden, supervisor).

PROFESSIONAL ACTIVITIES

Member, Geothermal Resources Council, GRC

Member, Technical Review Committee for 1983 Annual Meeting, GRC

PUBLICATIONS

Priest, G.R., Phenocryst-groundmass distribution coefficients for some intermediate lavas of the Little Walker volcanic center, Mono County, California: in manuscript, 11 p.

-----1978, Trace and major element evidence for the origin of quartz latite and aluminous low-Mg latite: Oregon Academy of Science Proceedings, v. 14, p. 154-155.

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-----Noble, D.C., Bowman, H.R., Geochemistry of a potassic volcanic center, Little Walker center, Mono County, California: in manuscript, 10 p.

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-----Noble, D.C., Bowman, H.R., Hebert, A.J., and Wollenberg, H.A., 1975, Eruptive and geochemical evolution of the Little Walker volcanic center: California Division of Mines and Geology, California Geology, v. 28, no. 5, p. 106.

-----Bowman, H.R., Hebert, A.J., Silberman, M.L., Street Jr., K., and Noble, D.C., 1974, Eruptive history and geochemistry of the Little Walker volcanic center, east-central California. A progress report: Geological Society of America Abstracts with Programs, v. 6, p. 237.

-----Riccio, J., Woller, N., Gest, D., and Pitts, S., Heat flow along the High Cascade-Western Cascade transition zone, Oregon: Oregon Academy of Science Proceedings, v. 16, in press.

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- Priest, G.R., Black, G.L., and Woller, N.M., 1982, Oregon low-temperature resource assessment program. Final technical report: Oregon Department of Geology and Mineral Industries Open-File Report O-82-5, 53 p.
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- Priest, G.R., Vogt, B.F., and Black, G.L., eds., 1983, Survey of potential geothermal exploration sites at Newberry Volcano, Deschutes County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-83-3, 174 p.
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DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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1982

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BUDGET SUMMARY

Personnel

Geologist III (2,650 x 5 months)	\$13,250	
x 1.4695 (46.95% O.P.E)		<u>\$19,471</u>

Services and Supplies

Travel

2 mo x 20 days/mo x \$44 per diem	\$ 1,760
2 mo x \$600/mo ave. truck cost	1,200

Analytical Expenses

Whole-rock analyses (80 x \$50 ea)	4,000	
K-Ar dates (6 - Paul Damon's lab)	0	
Thin sections (300 @ \$5.50 ea)	1,650	<i>4 wk</i>
X-ray diffraction (75 @ \$50 ea)	3,750	<i>1 1/2</i>
Fluid inclusion analyses (25 @ \$50)	1,250	<i>1 wk</i>

Direct Supplies

Air photos	500
Sample bags, etc.	300

Publication

Open-file report	10,000
Journal articles, talks	<u>1,000</u>

\$25,410

Subtotal

\$44,881

Indirect Costs @ 19.19%

\$ 8,613

Total

\$53,494

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
INDIRECT COST CALCULATIONS BASED ON 1985-87 BUDGET

General and Administrative Expense

PERSONNEL

Z6320	Director	\$102,036	
Z3064	Deputy Director	81,762	
Z0010	Management Assistant	38,340	
X0051	Business Manager	59,580	
C0010	Administrative Assistant	<u>32,784</u>	
			\$ 314,502
	Other Payroll Expense		<u>109,789</u>
	Total Personnel		\$ 424,291

SERVICES AND SUPPLIES

(1)	In-state travel	15,341	
(2)	Regional and out-of-state travel	8,200	
(3)	Office expense		
	(a) Phones	5,296	
	(b) General Services service charge	20,499	
	(c) Office expense	10,144	
(4)	Fiscal control	13,500	
	Insurance	3,773	
	Housing and Grounds	<u>11,462</u>	
	Total Service & Supplies		\$ 88,215
	Total Overhead		\$ 512,506
	Total Projected Expenditures	3,282,841	
	less Overhead 512,506 & equipment 99,149 =	611,655	
			<u>\$2,671,186</u>

$$\frac{512,506}{2,671,186} = 19.19\%$$

GEOLOGY AND MINERAL INDUSTRIES

O.P.E. (other payroll expense)

(July 1, 1985)

Direct O.P.E.		31.95
FICA		7.12
PERS		17.23
Other		7.6
SAIF, WCB	.5	
Medical	5.2	
Dental	1.0	
Other, ERB, Metro, Assessments	.9	
Indirect O.P.E.		15.0
Sick leave		
Vacation		
Holidays		
Personal leave		
Other		
TOTAL		46.95

STATEMENT OF WORK

1.0 SCOPE

The Oregon Department of Geology and Mineral Industries (DOGAMI) will conduct a feasibility study for future Cascades research and will prepare a detailed geologic map of a 15' quadrangle. The feasibility study will be directed toward defining a scientific drilling plan. The geologic mapping will be directed toward determining the geologic association and location of abnormally high heat sources--this information can be used for locating shallow temperature gradient and deeper scientific drill holes. The work will be accomplished according to the following tasks:

- 1.1. Feasibility Study: A study will be conducted to develop a plan for further research, particularly scientific drilling in the Cascade mountains of Washington, Oregon, and California. The drilling plan would focus on deep holes which would penetrate the "rain curtain" effect and provide information on the magmatic and hydrothermal processes. The scientific, industry, and governmental communities will be consulted and coordinated with as a means of accomplishing this task. The finished plan will be printed and distributed to interested persons and organizations.
- 1.2. Geologic Map Preparation: A detailed geologic map of the McKenzie Bridge 15' Quadrangle will be prepared and printed. Considerable field mapping and sample collecting will be integrated with several methods of sample analyses to produce the finished geologic map. The finished map will be printed in color and will be accompanied by the supporting data, including sample locations and sample analyses. A description of the geologic features and an interpretation of the map, especially as related to geothermal potential, will also either be included with the map or as a separate publication.
- 1.3. Project Management and Reporting: This grant is an addition to DE-FG07-84ID12526. The Oregon DOGAMI will continue to provide overall project management and will complete and report on tasks in a timely manner. Management reports shall be provided as defined by the original DOE Form EIA 459A Reporting Requirements Checklist but with modifications so as to include the Feasibility Study and Geologic Map Preparation which tasks are added herein. The required reports are also summarized as follows:

*add tasks &
timing -
to 4-30-87
10-15-85 update*

<u>REPORT</u>	<u>DUE</u>
Form DOE 538 Notice of Energy RD&D	30 days after award of addition to grant
Quarterly Management Summary Report	15 days after calendar quarter end
Project Status Report	15 days after calendar quarter end
Feasibility Study Plan	12-31-85
3 Geologic Maps, as described in 6-25-84 original grant	6-22-86
Final Report (draft)	45 days prior to completion date of this addition to grant
Compilation of Temperature-Depth Data and Heat-Flow Values	On completion date of this addition to grant
1 Geologic Map of McKenzie Bridge 15' Quadrangle	On completion date of this addition to grant
Final Report - to include all work from 6-25-84 to completion date (scheduled for 9-30-87)	On completion date of this addition to grant (scheduled for 9-30-87)

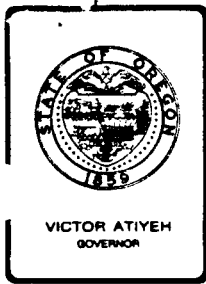
2.0. Deliverables:

The following deliverables will be added to those previously specified under this grant.

Task 1.1. Feasibility Study: The deliverable for this task will be a printed scientific plan for further research, particularly scientific drilling, in the Cascades of Washington, Oregon, and California. The plan will be delivered to U.S. DOE by 12-31-85. The plan will include all information and be presented in a fashion consistent with professional geological practices.

Task 1.2. Geologic Map Preparation: The deliverable for this task will be a colored geologic map of the McKenzie Bridge 15' Quadrangle complete with supporting data, description, and interpretation. Some of the supporting information may be contained in a separate publication. This map will be delivered to U.S. DOE at the end of the contract.

Task 1.3. Project Management and Reporting: Reports described in paragraph 1.3. will be prepared and issued in the amounts and at the frequency shown. The deliverables noted herein (2.0 Deliverables) are also mentioned in paragraph 1.3. along with those due under the original grant which commenced 6-25-84.



Department of Geology and Mineral Industries
ADMINISTRATIVE OFFICE

1005 STATE OFFICE BLDG., PORTLAND, OREGON 97201 PHONE (503) 229-5580

January 3, 1985

Susan Prestwitch
U.S. Department of Energy
Idaho Operations Office
550 Second Street
Idaho Falls, Idaho 83401

Dear Susan:

Enclosed is a proposal for support of our geothermal research program. The proposed tasks should be viewed as a supplement to work being pursued under Grant No. DE-FG07-84-ID-12526, "Geothermal Research, Oregon Cascades."

Our ultimate goal is development of a quantitative model for the magmatic and hydrothermal systems operating in the Cascades. This proposal solicits support for continued geologic mapping in the High Cascade-Western Cascade transition zone. Funds are also sought for preparation of a scientific plan for future research in the Cascades. The emphasis of the scientific plan will be scientific drilling which will penetrate the "rain curtain" effect in the High Cascades. We are hoping that this plan will aid USDOE as it begins to clarify its role in the emerging Continental Scientific Drilling Program.

Sincerely,

George R. Priest
Geothermal Specialist

GRP:ab
Encl.
CC: Marshall J. Reed
Clayton Nichols

RECEIVED

JAN 11 1984

ADVANCE TECHNOLOGY
H

UNSOLICITED RESEARCH PROPOSAL
SUBMITTED TO DIVISION OF GEOTHERMAL ENERGY
U.S. DEPARTMENT OF ENERGY

Title

GEOTHERMAL RESEARCH, OREGON CASCADES
GEOLOGIC MAPPING AND SCOPING OF FUTURE WORK

By

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
1005 State Office Building
Portland, Oregon 97201

Amount Requested: \$159,871

Begin: February 1, 1985

End: September 30, 1987

ENDORSEMENTS

Principal Investigator

George R. Priest 12-20-84
George R. Priest, Geothermal Specialist

Approving Administrative Official

Donald A. Hull 1/3/85
Donald A. Hull, State Geologist

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INTRODUCTION

This proposal is aimed at additional geologic mapping in the Oregon Cascades and development of a comprehensive plan for future research in the Cascade Range of Washington, Oregon, and California. The Department of Geology and Mineral Industries (DOGAMI) has, for the last year, been developing a national constituency of investigators interested in research in the Cascades as part of the emerging Continental Scientific Drilling Program. Funds are needed for preparation of a scientific plan for further work, particularly scientific drilling, in the Cascades. Support is also sought for detailed geologic mapping of the structural boundary between the High Cascades and the Western Cascade Range. This boundary zone contains most of the known hydrothermal systems in the Cascades.

The proposed work is the logical follow-up on geothermal research conducted for USDOE under the Cascade Resource Assessment Program (Cooperative Agreement No. DE-FC07-791D12044); the current DOGAMI grant, Geothermal Research, Oregon Cascades (Grant No. DE-FG07-841D12526); and other USDOE-sponsored Cascade work. Previous DOGAMI research was aimed at broad regional surveys which outlined the regional geologic framework and heat flow of the Western Cascades. It is now time to assess the geothermal potential of the High Cascades by quantitative modeling of the magmatic and hydrothermal processes. This work was not done in earlier programs owing to time limitations and to the expense of drilling deeply enough to penetrate below the "rain curtain" of rapidly circulating groundwater which characterizes the High Cascade Range. The proposed scientific plan and detailed geologic mapping should provide a framework for pursuing more ambitious drilling programs which will answer vital questions about the geology and overall geothermal potential of the Cascade Range.

ORGANIZATION AND MANAGEMENT PLAN

The Department of Geology and Mineral Industries is responsible under Oregon state law for the conduct of geologic research and the regulation for the exploration and development of minerals and mineral fuels including geothermal energy. DOGAMI and its predecessor organization have been in existence since 1913. The agency has a staff of ten geologists and engineers; a chemical, assay and spectrographic laboratory; library; cartographic facilities; and an editorial accounting staff. These facilities will be available to the project described in this proposal at no additional cost.

DOGAMI has been engaged in continuing geothermal research, involving a variety of geological, geochemical and geophysical studies, for the past seventeen years. The results of these efforts are included in the attached geothermal publications list.

The principal investigator is Dr. George R. Priest, Geothermal Specialist, DOGAMI. Dr. Priest recently completed heat flow and geologic studies in the northern Cascades of Oregon and supervised ongoing research into assessment of various areas of eastern Oregon for direct-use geothermal resources. The latter study included geologic, heat flow, and geochemical investigations. Prior to coming to DOGAMI, Dr. Priest worked for the Geothermal Division of Chevron Resources Company. While with Chevron, he completed all of the detailed geologic mapping for the Beowawe KGRA, Nevada. The Beowawe area will shortly be the first site in the northern Basin and Range to begin generating electrical power from geothermal energy. Prior to working in geothermal energy, Dr. Priest conducted research in volcanic petrology and managed mineral exploration programs in industry.

The management structure for the current geothermal research program is presented in Figure 1. Dr. Priest (Geologist IV) supervises the program with the help of two senior geologists (Geologists III's).

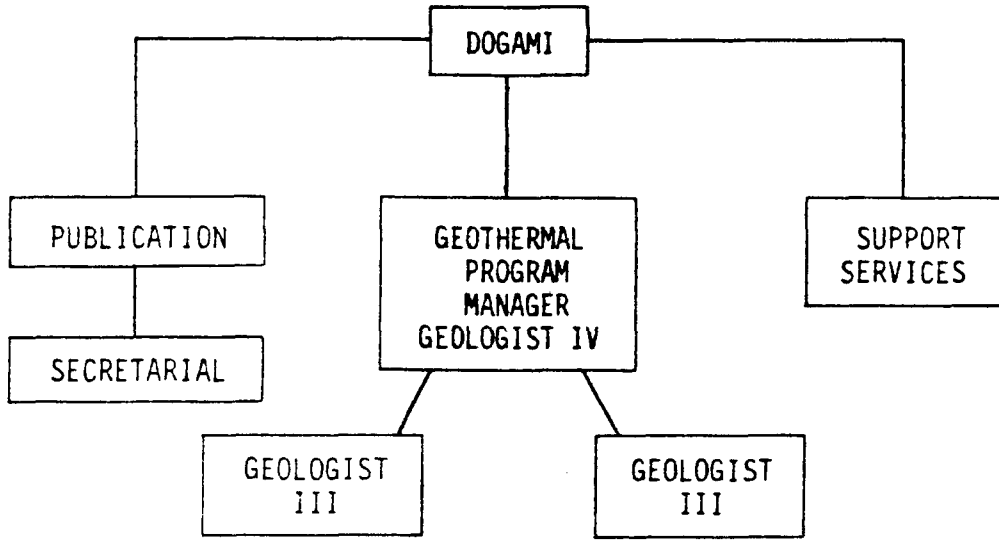


Figure 1. Organization chart.

TASK DESCRIPTIONS

It is proposed that these tasks be added to existing Grant No. DE-FG07-841D12526.

Geoscience Board - de. L. L. L. L. L.

TASK I SCIENTIFIC PLAN - PREPARATION AND PRESENTATION

A plan for further research, particularly scientific drilling, in the Cascades of Washington, Oregon, and California will, after appropriate review and coordination, be printed for distribution to interested persons and organizations. Dissemination of information about the plan will also be accomplished by oral presentations to interested groups.

The deliverable for this task will be the printed plan.

TASK II - GEOLOGIC MAPPING

A colored geologic map of the McKenzie Bridge 15' Quadrangle (Figure 2) will be prepared and printed. The map area covers the Belknap-Foley hydrothermal system.

The deliverable for this task will be the printed geologic map.

DUE DATES FOR DELIVERABLES

Task I - Printed scientific plan: 9-30-85

Task II - McKenzie Bridge 15' Quadrangle: 9-30-87

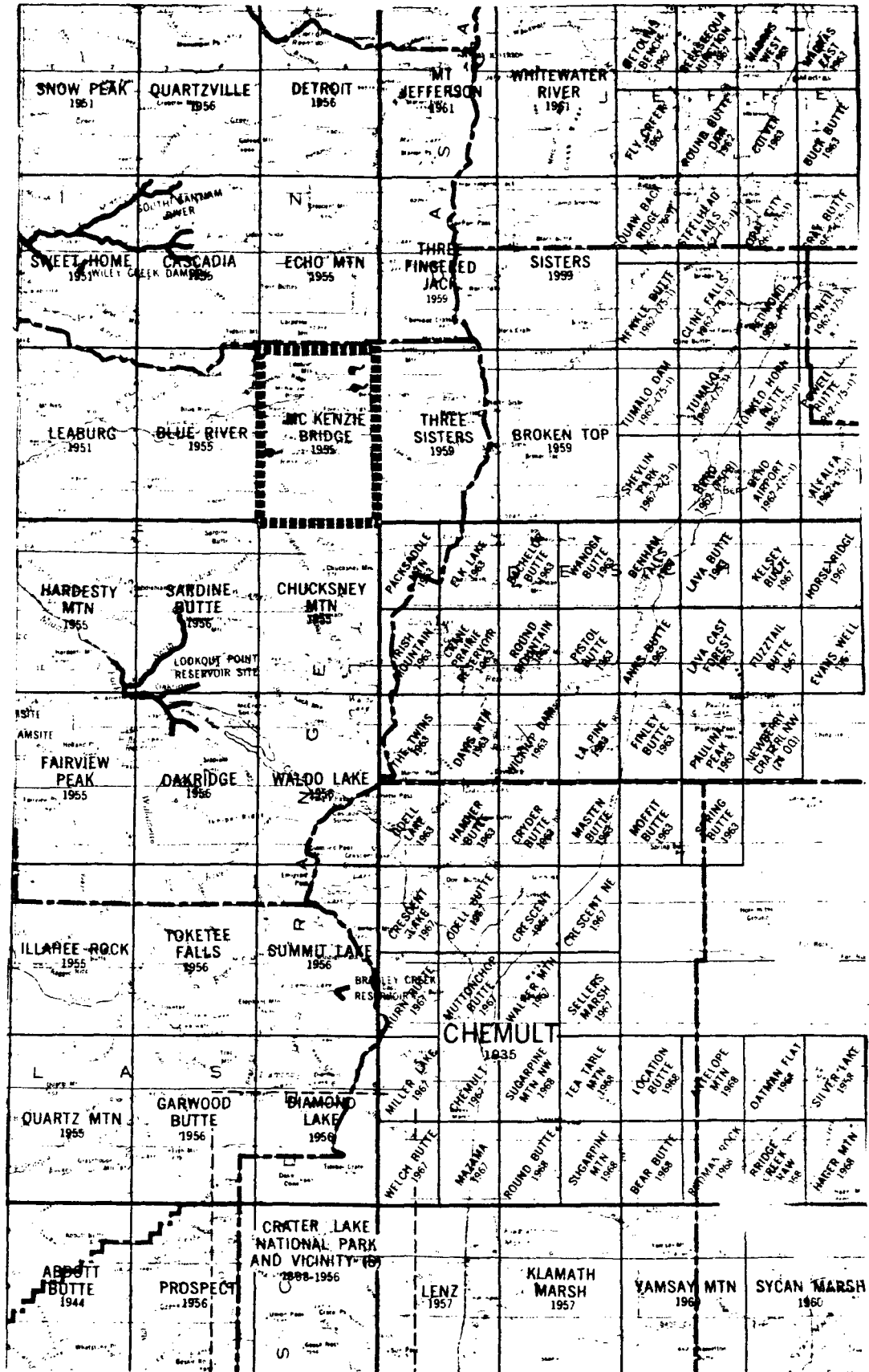


Figure 2. Index showing the McKenzie Bridge Quadrangle. Local hot springs are shown as dots with tails.

PATENT INFORMATION

There is no proprietary information included in this proposal, and the information to be collected during the proposed study will not be confidential.

APPLICATIONS TO OTHER SPONSORS

This proposal has not been submitted to other potential sponsors, and we do not plan to submit it to others in the future.

GEORGE R. PRIEST
10710 Southwest Ponderosa Place
Tigard, Oregon 97223
(503) 229-5580

EDUCATION

Academic:

B.S., Geology, Oregon State University, Corvallis, Oregon, 1971
M.S., Geology, University of Nevada, Reno, Nevada, 1974
Ph.D., Geology, Oregon State University, Corvallis, Oregon, 1979

Professional:

- o Technical Training Course No. 7, Introduction to Geothermal Log Interpretation, April 1981. Sponsor - GRC.
- o Short Course, Geothermal Potential of the Cascade Mountain Range, May 1981. Sponsor - GRC. WSEO, ODOE.

PROFESSIONAL EXPERIENCE

Geologist 4, Geothermal Specialist, Oregon Department of Geology and Mineral Industries, 11-1-80 to present (Dr. Donald A. Hull, supervisor).

Geologist 3, Oregon Department of Geology and Mineral Industries, 1005 State Office Building, Portland, Oregon 97201, 9-3-79 to 10-31-80 (Dr. Joseph Riccio, supervisor).

Geothermal Exploration Geologist, Chevron Resources Company, P.O. Box 3722, San Francisco, California 94119, 6-20-79 to 9-15-79 (Jim Salvesson, supervisor).

Consulting Geologist, to Hanna Mining Company, Coastal Mining Division, 388 W. 2550 S., Salt Lake City, Utah 84115, 3-20-78 to 3-23-78; 3-27-78 (Wade Hodges, supervisor).

Geochemist, Lawrence Livermore Laboratory, P.O. Box 808, Livermore, California 94550, 7-5-77 to 9-7-77 (Dr. Kevin K. Knauss and Dr. Terry L. Steinborn, supervisors).

Exploration Geologist, Cyprus Mines Corporation, S. 400 Jefferson Street, Suite 161, Spokane, Washington 99204, 7-25-74 to 9-15-75 (Dr. E.A. Schmidt, supervisor).

Consulting Geologist; to Mr. Bruce Miller, consulting exploration geologist, Geology Department, University of Nevada, Reno, Nevada 89502, 7-1-74 to 7-6-74.

Consulting Geologist, Project Manager, for Dr. D.B. Slemmons, Geology Department, University of Nevada, Reno, Nevada 89502, 11-73 to 3-74.

Engineering Geologist, Woodward-Clyde and Associates, Berkeley, California; 5 days 1-74 (Alfred Ringa, supervisor).

Exploration Geologist, Phelps Dodge Corporation, Reno, Nevada 89502, 6-15-72 to 9-15-72 (Robert Ludden, supervisor).

PROFESSIONAL ACTIVITIES

Member, Geothermal Resources Council, GRC

Member, Technical Review Committee for 1983 Annual Meeting, GRC

PUBLICATIONS

Priest, G.R., Phenocryst-groundmass distribution coefficients for some intermediate lavas of the Little Walker volcanic center, Mono County, California: in manuscript, 11 p.

-----1978, Trace and major element evidence for the origin of quartz latite and aluminous low-Mg latite: Oregon Academy of Science Proceedings, v. 14, p. 154-155.

-----Latites, quartz latites: in Fairbridge, R., and Green J., eds., Volcanoes and volcanology: Dowden, Hutchinson and Ross, Inc., publishers, in press, 5 p.

-----Noble, D.C., Bowman, H.R., Geochemistry of a potassic volcanic center, Little Walker center, Mono County, California: in manuscript, 10 p.

-----Noble, D.C., and Dickinson, W.R., Geologic evolution of the Little Walker volcanic center, Mono County, California: in manuscript, 20 p. plus map at 1:24,000.

-----Noble, D.C., Bowman, H.R., Hebert, A.J., and Wollenberg, H.A., 1975, Eruptive and geochemical evolution of the Little Walker volcanic center: California Division of Mines and Geology, California Geology, v. 28, no. 5, p. 106.

-----Bowman, H.R., Hebert, A.J., Silberman, M.L., Street Jr., K., and Noble, D.C., 1974, Eruptive history and geochemistry of the Little Walker volcanic center, east-central California. A progress report: Geological Society of America Abstracts with Programs, v. 6, p. 237.

-----Riccio, J., Woller, N, Gest, D., and Pitts, S., Heat flow along the High Cascade-Western Cascade transition zone, Oregon: Oregon Academy of Science Proceedings, v. 16, in press.

Priest, G.R., and Vogt, B.F., eds., 1982, Geology and geothermal resources of the Cascades, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-82-7, 206 p.

Priest, G.R., and Vogt, B.F., eds., 1982, Geology and geothermal resources of the Mount Hood area: Oregon Department of Geology and Mineral Industries Special Paper 14, 100 p.

- Priest, G.R., Black, G.L., and Woller, N.M., 1982, Oregon low-temperature resource assessment program. Final technical report: Oregon Department of Geology and Mineral Industries Open-File Report O-82-5, 53 p.
- Priest, G.R., and Vogt, B.F., eds., 1983, Geology and geothermal resources of the central Oregon Cascade Range: Oregon Department of Geology and Mineral Industries Special Paper 15, 123 p.
- Priest, G.R., Vogt, B.F., and Black, G.L., eds., 1983, Survey of potential geothermal exploration sites at Newberry Volcano, Deschutes County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-83-3, 174 p.
- Brown, D.E., McLean, G.D., Priest, G.R., Woller, N.M., and Black, G.L., under the direction of Riccio, J.F., 1980, Preliminary geology and geothermal resource potential of the Belknap-Foley area, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-80-2.
- Blackwell, D.D., Black, G.L., and Priest, G.R., 1981, Geothermal gradient data (1978, 1979, 1980): Oregon Department of Geology and Mineral Industries Open-File Reports O-81-3A, 63 p.; O-81-3B, 86 p.; and O-81-3C, 374 p.
- Blackwell, D.D., Black, G.L., and Priest, G.R., 1982, Geothermal gradient data (1981): Oregon Department of Geology and Mineral Industries Open-File Report O-81-4, 429 p.

STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
GEOTHERMAL ENERGY PUBLICATIONS

1966

Bodvarsson, G., 1966, Energy and power of geothermal resources: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 28, no. 7, p. 117-124.

Groh, E.A., 1966, Geothermal energy potential in Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 28, no. 7, p. 125-135.

1967

Peterson, N.V., and Groh, E.A., 1967, Geothermal potential of the Klamath Falls area, Oregon, a preliminary study: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 29, no. 11, p. 209-231.

1969

Godwin, L.H., and Peterson, N.V., 1969, Geothermal energy, in Mineral resources of Oregon: Oregon Department of Geology and Mineral Industries Bulletin 64, p. 299-304.

1970

Bowen, R.G., and Peterson, N.V., 1970, Thermal springs and wells in Oregon: Oregon Department of Geology and Mineral Industries Miscellaneous Paper 14 (listed on back of location map, scale 1:1,000,000).

1971

Bowen, R.G., 1971, Geothermal activity in 1970: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 33, no. 1, p. 16-18.

1972

Bowen, R.G., 1972, Geothermal activity in 1971: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 34, no. 1, p. 12-15.

Bowen, R.G., 1972, Geothermal gradient studies in Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 34, no. 4, p. 68-71.

1973

Bowen, R.G., 1973, Geothermal activity in 1972: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 35, no. 1, p. 4-5.

Bowen, R.G., and Blackwell, D.D., 1973, Progress report on geothermal measurements in Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 35, no. 1, p. 6-7.

1974

Bodvarsson, G., 1974, Telluric current exploration for geothermal anomalies in Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 36, no. 4, p. 93-107.

1974 (continued)

- Bowen, R.G., 1974, Geothermal activity in 1973: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 36, no. 1, p. 9-11.
- Walker, G.W., 1974, Some implications of late Cenozoic volcanism to geothermal potential in the High Lava Plains of south-central Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 36, no. 7, p. 109-119.

1975

- Bowen, R.G., 1975, Geothermal activity in 1974: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 37, no.1, p. 9-10.
- Bowen, R.G., 1975, Geothermal gradient data: Oregon Department of Geology and Mineral Industries Open-File Report O-75-3, 114 p.
- Bowen, R.G., 1975, Geothermal power, in Proceedings of the Citizens' Forum on Potential Future Energy Sources, Portland, Oreg., January 17, 1974: Oregon Department of Geology and Mineral Industries Miscellaneous Paper 18, p. 43-50.
- Bowen, R.G., and Blackwell, D.D., 1975, The Cow Hollow geothermal anomaly: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 37, no. 7, p. 109-121
- Bowen, R.G., Blackwell, D.D., and Hull, D.A., 1975, Geothermal studies and exploration in Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-75-7, 66 p.
- Couch, R.W., French, W., Gemperle, M., and Johnson, A., 1975, Geophysical measurements in the Vale, Oregon, geothermal resource area: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 37, no. 8, p. 125-129.
- Hull, D.A., 1975, Geothermal gradient data, Vale area, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-75-4, 18 p.
- Hull, D.A., 1975, Geothermal studies in the Vale area, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 37, no. 6, p. 104-106.
- Larson, K., and Couch, R.W., 1975, Preliminary gravity maps of the Vale area, Malheur County, Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 37, no. 8, p. 138-142.

1976

- Bowen, R.G., Blackwell, D.D., Hull, D.A., and Peterson, N.V., 1976, Progress report on heat-flow study of the Brothers fault zone, central Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 38, no. 3, p. 39-45.
- Hull, D.A., 1976, Electrical resistivity survey and evaluation of the Glass Buttes geothermal anomaly: Oregon Department of Geology and Mineral Industries Open-File Report O-76-1, 11 p.
- Hull, D.A., Bowen, R.G., Blackwell, D.D., and Peterson, N.V., 1976, Geothermal gradient data, Brothers fault zone, central Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-76-2, 24 p.
- Hull, D.A., and Newton, V.C., 1976, Geothermal activity in 1975: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 38, no. 1, p. 10-17.

1977

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- Hull, D.A., Blackwell, D.D., Bowen, R.G., and Peterson, N.V., 1977, Heat-flow study of the Brothers fault zone, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-77-3, 43 p.
- Hull, D.A., Blackwell, D.D., Bowen, R.G., Peterson, N.V., and Black, G.L., 1977, Geothermal gradient data: Oregon Department of Geology and Mineral Industries Open-File Report O-77-2, 134 p.
- Hull, D.A., and Newton, V.C., 1977, Geothermal activity in 1976: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 39, no. 1, p. 7-15.
- Wimer, R.D., LaMori, P.N., and Grant, A.D., 1977, Potential environment issues related to geothermal power generation in Oregon: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 39, no. 5, p. 73-91.

1978

- Blackwell, D.D., Hull, D.A., Bowen, R.G., and Steele, J.L., 1978, Heat flow of Oregon: Oregon Department of Geology and Mineral Industries Special Paper 4, 42 p.
- Bowen, R.G., Peterson, N.V., and Riccio, J.F., 1978, Low- to intermediate-temperature thermal springs and wells in Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-10 (listed on back of location map, scale 1:1,000,000).
- Couch, R.W., Gemperle, M. and Connard, G., 1978, Total field aeromagnetic anomaly map, Cascade Mountain Range, central Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-9, scale 1:125,000.
- Hull, D.A., Blackwell, D.D., and Black, G.L., 1978, Geothermal gradient data: Oregon Department of Geology and Mineral Industries Open-File Report O-78-4, 187 p.
- Newton, V.C., and Hull, D.A., 1978, Geothermal Energy in 1977: Oregon Department of Geology and Mineral Industries, Ore Bin, v. 40, no. 1, p. 8-16.
- Oregon Department of Geology and Mineral Industries, 1978, Geophysical logs, Old Maid Flat #1, Clackamas County, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-78-6, 2 p., 7 logs.
- Pitts, G.S., and Couch, R.W., 1978, Complete Bouguer gravity anomaly map, Cascade Mountain Range, central Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-8, scale 1:125,000.

1979

- Riccio, J.F., ed., 1979, Geothermal resource assessment of Mount Hood: Oregon Department of Geology and Mineral Industries Open-File Report O-79-8, 273 p., 5 maps.
- Riccio, J.F., 1979, Preliminary geothermal resource map of Oregon: Oregon Department of Geology and Mineral Industries Geological Map Series GMS-11, scale 1:500,000.
- Riccio, J.F., and Newton, V.C., 1979, Geothermal exploration in Oregon in 1978: Oregon Department of Geology and Mineral Industries, Oregon Geology, v. 41, no. 3, p. 39-46.
- U.S. Geological Survey and Oregon Department of Geology and Mineral Industries, 1979, Chemical analyses of thermal springs and wells in Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-79-3, 170 p.
- Wollenberg, H.A., Bowen, R.G., Bowman, H.R., and Strisower B., 1979, Geochemical studies of rocks, water, and gases at Mt. Hood, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report O-79-2, 57 p.

1980

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1981 (continued)

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BUDGET SUMMARY

Personnel

Geologist III (2,296 x 15 months)	\$34,440	
Geologist III (2,296 x 4 months)	9,184	
x 1.464 (46.4% O.P.E.)		<u>\$ 63,866</u>

Services and Supplies

Travel

Air Fares for Coordination Meetings - Scientific Plan	\$ 6,000
Out-of-State Travel (meals and lodging)	4,000
10 mo. x 20 days/mo x \$42 per diem	8,400
10 mo. x \$600/mo. average truck expense	6,000

Analytical Expenses

Whole Rock Analyses (115 x \$50/sample)	5,750
K-Ar Analyses (6 @ \$400/date)	2,400
Thin Sections (300 @ \$5/section)	1,500
X-ray Diffraction (100 @ \$19/sample)	1,900

Direct Supplies

Map Bases and Air Photos	1,500
Sample Bags, etc.	700

Publication

McKenzie Bridge Quadrangle	10,000
Cascade Scientific Plan	20,000

\$ 68,150Subtotal\$132,016Indirect Costs @ 21.1%\$ 27,855TOTAL\$159,871

GEOLOGY AND MINERAL INDUSTRIES

OPE

(July 1, 1983)

Direct Overhead		31.4
FICA		6.7
PERS		18.8
Other		5.9
SAIF	1.1	
Medical	3.2	
Dental	0.4	
Other (Life		
Ins., ERB,		
Metro,		
Workers Comp.,		
Misc.)	1.2	
Indirect Overhead		15.0
Sick leave		
Vacation		
Other		
TOTAL		46.4%

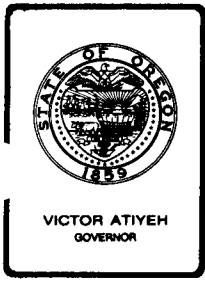
STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
INDIRECT COST CALCULATIONS FY 1983-85
GENERAL AND ADMINISTRATIVE EXPENSE

PERSONNEL

Z6320	Director	\$ 95,808	
Z3064	Deputy Director	78,768	
Z0010	Administrative Assistant	35,976	
Z0051	Business Manager	55,944	
C0101	Accounting Clerk	<u>30,096</u>	
			\$ 296,592
	Budgeted 83-85 OPE on PICS @ 35.7%		<u>105,883</u>
	Total Personnel		\$ 402,475

SERVICES AND SUPPLIES

(1)	In-state travel 83-85 budget	7,758	
	11,631 x .667		
(2)	Regional and out-of-state travel		
	83-85 budget 8,000 x .667	5,336	
(3)	Office expenses		
	a) Phones 3,590 x 1.5	5,385	
	b) General Services service charge		
	14,568 x .667	9,717	
	c) Central Stores	1,504	
	d) Copier	4,080	
(4)	Fiscal control	23,445	
	Insurance	2,658	
	Housing and grounds (670 x 60 x 24)	<u>9,648</u>	
	Total Services and Supplies		69,531
	Total overhead		472,006
	Total budget 2,712,532 less overhead		
	472,006		<u>\$2,240,526</u>
	Overhead rate		21.1%



Water Resources Department

MILL CREEK OFFICE PARK

555 13th STREET N.E., SALEM, OREGON 97310

PHONE 378-8456

April 22, 1985

Eldon Bray
U.S. Department of Energy
550 Second Street
Idaho Falls, ID 83401

Dear Eldon:

Enclosed is our research proposal for low temperature geothermal research. This is essentially as I described to you over the phone on April 18. Since the proposal was somewhat rushed, there are a few state "hoops" we have yet to jump through, including approval by the State Legislative Emergency Board, and our ability to fit this within our Federal expenditure limitation. Whether or not we can enter into an agreement with USDOE depends on these factors.

I hope this is what you need. If you have any questions, please call myself or Fred Lissner at the above phone number. I appreciate your interest in our program.

Sincerely,

MARSHALL GANNETT
Hydrogeologist

MG:wpc

enclosure
cc: Duncan Foley
8153C

→ resumes in mail last Mon.

→ office time, Or can pick up additional parts
geoth obs. net is field intensive



ESL 3-31-86

Water Resources Department

3850 PORTLAND ROAD NE, SALEM, OREGON 97310

PHONE 378-8456

March 10, 1986

William C. Drake, Chief
R&D Contracts Branch
U.S. Department of Energy
785 DOE Place
Idaho Falls, ID 83402

Dear Mr. Drake:

REFERENCE: Grant No. DE-FG07-85ID12598

I am sorry, and a bit embarrassed, to have to inform you that we will be unable to accept the subject grant. For the last few months we have been getting mixed signals from upper level administration. The fear is that if any federal funds are received, an equal amount of our general fund money will be pulled. With the added overhead, this would result a net loss to our agency. While we have been continually encouraged by administration to pursue the grant, we have received no committment from them that we can actually accept the money. Because I do not see the issue being resolved in the immediate future, I feel it would be unfair to the Department of Energy to continue this waiting any longer.

I realize that to get this grant to this point represents a fair amount of effort by DOE personnel in addition to personnel of our agency, and do not take this lightly. I can assure you that we will require an absolute committment from all levels before approaching DOE with another proposal. I hope this does not jeopardize our chances for possible future funding.

Sincerely,

MARSHALL GANNETT
Hydrogeologist

MG:wpc

3417D



Water Resources Department

3850 PORTLAND ROAD NE, SALEM, OREGON 97310

PHONE 378-8456

January 15, 1986

Ron King
US Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, ID 83402

Dear Mr. King:

REFERENCE: Grant No. DE-FG07-85ID12598

We have received the three copies of the subject Grant which have been signed by DOE, but have not yet received clearance from all levels of administration here to sign and return them. I anticipate we will be able to return them within two weeks. Please contact me if there are any problems.

The project period (Box 7) on the Notice of Financial Assistance Award is from December 1, 1985 to December 2, 1986. I had originally requested a two-year project period in the proposal. I would still like to have a two-year period in which to accomplish the tasks. This will enable us to collect more data on our low temperature geothermal observation network and more time to organize aquifer tests. This is particularly important in light of the fact that we may be getting a delayed start. Please let me know if it will be possible to extend the project period to December 1, 1987.

I apologize for not contacting you sooner, please call me if you need any further information.

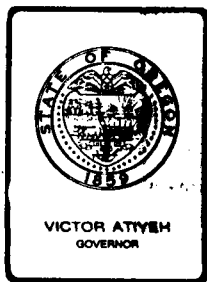
Sincerely,

MARSHALL GANNETT
Hydrogeologist

MG:wpc

2113D

1/21/86



Water Resources Department

MILL CREEK OFFICE PARK

555 13th STREET N.E., SALEM, OREGON 97310

PHONE 378-8456

September 4, 1985

Peggy A.M. Brookshire
Project Manager
Advanced Technology Division
US Department of Energy
Idaho Operations Division
Idaho Falls, ID 83401

Dear Ms. Brookshire:

This letter is in response to your letter dated August 2, 1985 to Fred Lissner of this office. I apologize for the slow reply. I have enclosed the "Assurances" form signed by Mr. Ken Weese, the head of our Administrative Services Division.

With regard to the indirect costs I've included in the budget on our proposal, our agency does not have a negotiated agreement with the Department of Energy. Our budget person here informs me that there has never been a breakdown of the budget from which indirect costs have actually been calculated. The figure I've used (20%) is what we consider a reasonable estimate of our overhead for such things as rent, utilities, phones, administrative services, etc. This is the figure that Dr. George Priest of the Oregon Department of Geology and Mineral Industries has used for past geothermal grants from the Department of Energy. The overhead costs should be very similar for our two agencies. Dr. Priest is out of town for a week so I cannot reach him to find out the exact arrangements they made with the Department of Energy for justification of indirect costs. I will contact him and find out the details as soon as I can and let you know via telephone what I find out.

Please let me know if there is any specific type of information I can provide you with. Again, I apologize for the tardiness of this response.

Sincerely,

MARSHALL GANNETT
Hydrogeologist

MG:wpc

0229D



Water Resources Department

MILL CREEK OFFICE PARK

555 13th STREET N.E., SALEM, OREGON 97310

ESC 14 Aug '85

PHONE 378-8456

July 29, 1985

Peggy Brookshire
U.S. Department of Energy
550 Second Street
Idaho Falls, ID 83401

Enclosed please find a copy of our proposal with a revised budget, as we were requested to send to you by Duncan Foley.

Sincerely,

MARSHALL GANNETT
Hydrogeologist

MG:wpc

9727C

RECEIVED

JUL 31 1985

ADVANCED TECHNOLOGY
BRANCH

CONTENTS

INTRODUCTION 1

ORGANIZATION 2

TASK DESCRIPTIONS

 TASK I - Geothermal Aquifer Testing 3

 TASK II - Low Temperature Geothermal Observation Network 4

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INTRODUCTION

This proposal is for partial funding to conduct long-term (two to five weeks) pump tests of some of Oregon's low temperature geothermal aquifers, and to continue the semi-annual collection of temperature, discharge, water level, and limited chemical data from wells and springs on the statewide low temperature geothermal observation network.

While the existence of numerous low temperature geothermal aquifers in Oregon is well documented, little is known about their specific hydrologic characteristics, production potential, and how they will respond to development. This sort of information is needed both by potential resource developers for project conception and design purposes, and by government agencies with the responsibility for creating management schemes and assessing the potential impact of development. There are a number of low temperature areas in Oregon where development is occurring, or planned, for which little or no scientific aquifer testing has been conducted. The main geothermal areas of concern include the Vale, Lakeview, the Harney Basin, and the Grande Ronde Valley. The most likely areas for aquifer tests in the near future include Lakeview and Vale.

A statewide network of low temperature geothermal wells and thermal springs where temperature, discharge, water level, and certain chemical parameters are measured on a semi-annual basis was established in 1984. The purpose of the network is to provide baseline data for assessing the natural temporal variations in low temperature geothermal systems, as well as to detect any changes in the resource brought on by development. The lack of such a systematic historic data base has proven to present a major problem in assessing the importance of changes presently occurring in the Klamath Falls KGRA. The geothermal observation net is funded through the Oregon Department of Energy until June 30, 1985.

ORGANIZATION

The Oregon Water Resources Department is the agency responsible for management of all geothermal fluid under 250°F (121°C) produced from wells less than 2000 feet (610 M) deep. This includes all of the geothermal energy used in Oregon currently. Under state law, resource management must allow for maximum beneficial use of the geothermal system, yet ensure that it is managed as a perpetual resource. The majority of the responsibility rests with the Ground Water Division of the Water Resources Department.

The ground water division has a staff of eight geologists, including the division administrator, and one engineering technician. Six of the staff have graduate degrees, three in hydrogeology. Agency support services include drafting, word processing, administrative and accounting staff.

The principal investigator is Marshall Gannett, Hydrogeologist, Oregon Water Resources Department, Ground Water Division. Mr. Gannett has been involved in various aspects of high and low temperature geothermal exploration and development since 1977, and has been working as a hydrogeologist with Oregon Water Resources Department since May, 1984. Mr. Gannett (Geologist III) will be supervising and coordinating the research program, with technical assistance from other hydrogeological staff as necessary. Field assistance for pump tests will be provided by one or two Geologist II's. Data collection on the Geothermal Observation Net would be by one Geologist II.

TASK DESCRIPTIONS

Task I - Geothermal Aquifer Testing

At least one and possibly two long-term pump tests of geothermal aquifers will be conducted as part of this program during the time period covered by this proposal. Tests will be of at least three to five weeks in duration. Temperature, discharge rate, and water levels will be recorded for the pumped well, and water levels will be recorded continuously or intermittently in as many observation wells as possible or necessary. Results of the pump tests will be analyzed to determine hydraulic conductivity, transmissivity, storage coefficients, boundary conditions, and general hydrologic character of the geothermal aquifers. In addition, water samples from the pumped well taken during the test periodically will be analyzed for major ions, to assess any mixing or cold water incursion. Tests will be conducted utilizing existing wells and pumps. Data and interpretations will be completed, probably as open file reports, in a timely manner after the study is complete.

The deliverables for this task will be open file reports which include background information, description of the test(s), data, and interpretation of results. Reports will be delivered to the U.S. Department of Energy before the end of the contract period.

Task II - Low Temperature Geothermal Observation Network

Included in this project is the continued semi-annual monitoring of temperature, discharge, water level, and certain chemical parameters of the statewide geothermal observation network. This group of selected thermal wells and springs focuses on the areas which are developed or which are the subject of planned development. In certain areas where there is a need to determine the annual variations in temperature, water level or discharge, monthly or continuous monitoring may be conducted. Each feature on the network is documented with its map location, photographs, and well defined measuring points. Most publically available data has been compiled and included in each file. It is anticipated that we will continue monitoring this network with state funds after this contract expires.

The deliverable for this task will be an open file report including introduction to the network and its purpose, a description of each monitored feature, and a compilation of all the data collected to date. The report would be delivered to U.S. Department of Energy at the end of the contract period.

BUDGET SUMMARY

Personnel

Geologist III (1.5 months @ 1988) \$ 2982

Geologist II (2.5 months @ 1727) 4317

Subtotal x 1.385 (38.5% OPE) \$ 10,110

Service and Supplies

Travel

3 months x 20 days/mo. x \$42 per diem \$ 2520

2.5 months x \$800/mo. average vehicle costs 2000

Analytical Expenses

Water Analyses \$ 1000

Publication

Open file report preparation \$ 1000

Subtotal \$ 6520

Subtotal \$16,630

Total (including 20% indirect costs) \$19,956

9717C