

CONTRACTING AGENCY: Alaska Department of Environmental Conservation
 CONTRACT NUMBER(S): DE-EG07-21065006-2019-0009
 PRINCIPAL INVESTIGATOR(S): David L. ...

CONTRACT PERIOD	\$ CONTRIBUTION		WORK DESCRIPTION	LOCATION	REMARKS
	DOE	STATE			
5/15/20 - 7/31/20	658,000	39,470
5/15/20 - 6/30/20	204,450	56,785
5/15/20 - 5/31/20	400,000	19,000

D FORM-102 (Rev. 10-77)		U. S. DEPARTMENT OF ENERGY COOPERATIVE AGREEMENT PURSUANT TO AUTHORITY OF PL 93-410, PL 93-439, PL 93-473, PL 93-577, and PL 95-91		1 a. Agreement No. DE-FC07-79ID12044	1 b. Modification No.								
3. Participant Name and Address State of Oregon Department of Geology and Mineral Industries 1069 State Office Building Portland, Oregon 97201		2. Agreement Period From: May 23, 1979 To: July 30, 1980											
5. Project Title Geothermal Resource Assessment of the Western and Central Cascades, Oregon		4. Participant Type <input type="checkbox"/> Educational <input type="checkbox"/> Nonprofit <input checked="" type="checkbox"/> State or Local Government <input type="checkbox"/> Profit											
8. Principal Investigator(s) or Program Director(s) Name and Address Donald A. Hull State of Oregon, Department of Geology and Mineral Industries 1069 State Office Building Portland, Oregon 97201 Telephone:		6. Project Will Be Conducted Per See Article <u>II</u>											
10. Accounting and Appropriation Data 89X0210.91 503-229-5580		7. Technical Reports Are Required See Article <u>VII</u>											
12. Submit Vouchers, if any, to Agreements Officer Unless Otherwise Specified in this Block Director, Contracts Management Division, DOE-ID, 550 Second Street, Idaho Falls, Idaho 83401		9. DOE Program Officer (Name and Address) Leland L. Mink, Energy & Technology Division, DOE-ID 550 Second Street Idaho Falls, Idaho 83401 Telephone No. 208-526-0638											
13. Funding Sources		11. Method of Payment <input type="checkbox"/> % At Award. % When Requested. 5% Upon Receipt of Final Report <input type="checkbox"/> Letter of Credit <input type="checkbox"/> Reimbursement <input checked="" type="checkbox"/> Other (specify) See Article <u>IV</u>											
<table border="0"> <thead> <tr> <th>Source</th> <th>Amount</th> </tr> </thead> <tbody> <tr> <td>DOE:</td> <td>\$ <u>662,447.00</u></td> </tr> <tr> <td>Participant:</td> <td>\$ <u>30,472.00</u></td> </tr> <tr> <td>Total Funding</td> <td>\$ <u>692,919.00</u></td> </tr> </tbody> </table>		Source	Amount	DOE:	\$ <u>662,447.00</u>	Participant:	\$ <u>30,472.00</u>	Total Funding	\$ <u>692,919.00</u>	14. Remarks: Precontract Costs \$200,000.00 Post-Award Costs <u>462,447.00</u> <u>\$662,447.00</u>			
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DOE:	\$ <u>662,447.00</u>												
Participant:	\$ <u>30,472.00</u>												
Total Funding	\$ <u>692,919.00</u>												
15. Amount Obligated By This Action: \$ 662,447.00													
16. DOE Issuing Office (Name and Address) Idaho Operations Office 550 Second Street Idaho Falls, Idaho 83401													
17. DOE Cooperative Agreements Officer _____ (Signature) _____ (Date) Name (typed) _____ Title _____ Telephone No _____		18. Participant Acceptance By _____ Signature of Authorized Official Name (typed) _____ Title _____											

ARTICLE II - DESCRIPTION OF RESPONSIBILITIES (Cont'd)

Task 1 - Geology and Lineament Study

This is a one year effort entirely funded in the first year for \$116,115.00. The work scope will be composed of:

- a. Two areas in the Cascades have been identified for study during 1979. Geologic mapping, fault analysis and geothermal resource evaluation will be conducted at both sites. The two sites will be the upper Clackamas River Valley, and the upper portions of the Molalla and Little North Santiam Rivers. In addition to geologic mapping, funding is approved for radiometric age dating of rocks from the study area. Age dating techniques will include K/Ar and Ar⁴⁰/Ar³⁹ methods as outlined in the proposal. Craig M. White of the Department of Geology of University of Oregon will conduct this work.
- b. The lineament study will include examination various low angle and high space photographic surveys of the central western Cascades of Oregon in order to identify and verify major structures such as faults and lineaments. The product will be a series of lineament maps of 36 x 96 mile project area approximately bordered by 120°45' and 122°30'W. Longitude and 43°30' and 45°N. Latitude. Staff members of DOGAMI will conduct this work.
- c. As stated in attachment 3 of the proposal, five items of work will be conducted and will include:
 - 1) A comparative mapping study of mines, tectonic structures, breccias and hydrothermal alteration versus plutonic and volcanic rock distribution.
 - 2) K-Ar age determination of plutonic and hydrothermal minerals.
 - 3) Study and syⁿthesis of the petrochemistry of the plutonic and volcanic host rocks.
 - 4) Study of the distributions and variations of:
 - (a) alteration and metallic minerals of hydrothermal origin,
 - (b) trace elements in stream sediments and plutonic and volcanic host rocks.

DOGAMI staff members will conduct this work.

ARTICLE II - DESCRIPTION OF RESPONSIBILITIES (Cont'd)

Task 2 - Tectonic Framework Study

A one year tectonics study has been proposed for a total funding of \$34,167.00 and will include a detailed study of the nature and extent of tertiary rotation and deformation of rocks in the western Cascades. In addition the study will focus on the probable location of continental and oceanic plate boundaries in the area of the Coast Range and the western Cascades. Sampling of basalt flows at sites (as outlined in the proposal) in the western Cascades will be accomplished and the samples will be sent to Stanford University for cryogenic magnetometer analysis. Dr. Alan Cox of the Department of Geophysics at Stanford University will conduct this effort. The end product of this effort will be a report describing, in detail the tectonic framework of the western Cascades region.

Task 3 - Thermal Gradient Drilling Study

A three year thermal gradient study has been proposed for a total funding of \$729,680.00. The first year effort \$228,626, has been approved several holes will be drilled over an eight week period beginning approximately August 1, 1979. A suite of geophysical logs will be taken in each heat flow hole including temperature, resistivity, self-potential, and natural gamma. In addition to the drilling program, any previously existing wells (water wells, oil-test wells, mineral exploratory holes, etc.) will be tested for temperature gradients. The end product of this effort will be a report and heat flow interpretation maps of the western and central Cascades Region in Oregon. Staff members of DOGAMI will supervise the drilling subcontracts and will be responsible for the geophysical measurements, interpretations, report, and maps.

Task 4 - Geochemistry

A three year proposed effort for a total of \$53,128. The first year phase of work has been approved for \$20,557. The work will include sampling of thermal springs and wells in the study area for water analysis and geothermometry studies. The data will be submitted to the USGS, Menlo Park, California, for inclusion in the GEOTHERM data base file. The staff members of DOGAMI will conduct this work.

Task 5 - Publications

No effort during first year.

ARTICLE II - DESCRIPTION OF RESPONSIBILITIES (Cont'd)

Task 6 - A Gravity Survey in the Northern Oregon Cascades

This is a proposed three year effort; the first year workscope has been approved for \$65,000. The work to be conducted will include a gravity survey in the area between 44°15' and 45°45'N. Latitude and 121°00' and 122°30' W. Longitude. The product of this study will be a series of Bouguer anomaly maps at a 1:125,000 scale, and a report describing the study and conclusions. Dr. Richard W. Couch, Associate Professor in Geophysics, Oregon State University, will conduct this study. Equipment purchased under this task will include a plotter interface system, as outlined in the proposal.

Task 7 - Aeromagnetic and Gravity Measurements, Southern Cascades

This is a proposed 4 year effort, the first year work scope has been approved for \$197,982. The work will include an aeromagnetic survey and a gravity survey in the region between 42° and 43°N Latitude and 121° and 122°30'W. Longitude. The studies will determine the relatively large scale lithologic disturbances and near surface structures in the southern Cascades. The products of this study will be a map of the structural findings and a report describing the study and conclusions. Dr. Richard W. Couch, Associate Professor of Geophysics, School of Oceanography, Oregon State University, will conduct this work.

The Participant is also responsible for cost-sharing to the extent provided for in Article III, "Financial Support of the Project."

ARTICLE III - FINANCIAL SUPPORT OF THE PROJECT

A. The total estimated cost of performing the work under this Agreement is Six Hundred Ninety-Two Thousand Nine Hundred Nineteen Dollars (\$692,919.00). The Participant shall be reimbursed by DOE for not more than 95% of the costs of the project determined to be allowable in accordance with Article A-I of the General Provisions entitled "Allowable Costs." The remaining 5% or more of the costs of the project so determined shall constitute the Participant's share for which it will not be reimbursed by DOE. The total cost to DOE is hereby established as Six Hundred Sixty-Two Thousand Four Hundred Forty-Seven Dollars (\$662,447.00), and this amount is also the maximum amount of the project which is subject to reimbursement by DOE unless such maximum cost is changed in writing by the Contracting Officer.

B. In regard to any increase or decrease in the total estimated cost of this Agreement, as a result of any change in the original Statement of Work, as may be agreed upon by the parties during the term of this

Contract Modification to # DE-FC07-79ET 27220

STATE OF OREGON

DEPARTMENT of Geology and Mineral Industries (DOGAMI)

Principal Investigator: Joseph Riccio

Period of Performance: May 22, 1980 - May 21, 1981

WAYS AND MEANS:	DOE SHARE	\$ 400,000
	Capital Equip	-0-
	DOGAMI Share	<u>20,450</u>
	Total	<u>\$ 420,450</u>

Statement of Work

TASK 1 Data Compilation. Geological, geophysical, geochemical, and heat flow data for low temperature resource assessment will be collected in the Parkdale, Walla Walla, and McDermitt areas. A preliminary assessment of the area geothermal potential will be made based on all available geoscience information collected. Results of this task, including tabulation of data available for each area, interpretations of geothermal potential, and recommendations for additional assessment efforts in each area will be included in a final report for Mod Accn.

Task 2 Geologic Mapping. A geologic map, at an appropriate scale, extending into adjacent areas, will be produced for each of the resource areas described in Task 1. The map will depict lithology, topography, all known or inferred structures, and the location and identification of all thermal springs, geothermal deposits, and thermal wells of the area. Cross-sections based on available geologic and structural data will ~~be~~ drawn through the resource areas.

A lineament map will be constructed (at the same scale as the geologic map) for each area based on air-photo and LANDSAT imagery interpretations. Ground-truth verification of the lineaments will be performed. Copies of each map for each site, with accompanying description and interpretation of results, will be included in a final report for Mod A001.

Task 3 Temperature Gradient Study. A subcontract will be issued to perform gradient drilling in the following areas: Belknap-Foley, Williamsite Pass,

and the Honey Basin. Drilling will be limited to a maximum of 2000 feet ^{total drilling and depth} in each area. Actual number of holes in any area will be at the discretion of the principal investigator. Any drilling funds remaining after drilling the above three Resource areas will be utilized in the drilling of holes in the Parkdale area.

DOGAMI will review and select a drilling subcontractor on a "best efforts," most cost-effective basis. The subcontract must obtain ^{A TECHNICAL} review and approval by DOE prior to award.

In addition to the above-mentioned drilling program, and scrounge, or free holes, located within these resource areas (water wells, oil test wells, mineral exploratory holes) will be measured for temperature gradients and water samples.

Task 5 Geochemistry. A program of thermal spring and well water sampling will continue this year for resource areas that have not been included in previous years studies. Water samples will be analyzed, geothermometry will be computed, and these data will be submitted to the USGS GEOTHERM data base. These data will also be included in the comprehensive

determination for each resource area in the final report for Mod A001.

Task 6

State-wide Reconnaissance. A continuing effort ^{will be made} to acquire information (location, temperature measurement, water sample, flow data, etc) on thermal springs and wells throughout the State of Oregon. These data will be included in existing data base files and updates of the geothermal map series of Oregon.

Task 7

Reports and Publications. Reports will be prepared in accordance with DOE Form CR-537 (included within), to include monthly technical and management summary reports, and a final report of work conducted under Mod A001. The final report will be comprehensive of each resource area studied, tasks performed, and recommendations for each area. If funds are available in this modification for the publication of individual treatises of some of the resource areas, numbers of copies and publication format will be discussed and approved by DOE. Prior to publication, a draft final copy of

treatise will be forwarded to DOE for review
and approval.

ARTICLE II - DESCRIPTION OF RESPONSIBILITIES (Cont'd)

Task 1 - Data Compilation

Available published geological, geophysical, geochemical, and heat flow data for the low temperature resource areas identified in Phase I (Belknap-Foley, Willamette Pass, Craig Mountain-Cove, Western Snake River Plain, Glass Buttes, Northern and Southern Harney Basins, Alvord and Lakeview (Fig. 2) will be compiled as a basis for determining which additional studies may be needed to complete the process for site selection.

Task 2 - Geologic Mapping

Initial assessment of the nine resource areas will consist, in part, of geologic mapping and air-photo and imagery interpretation.

A geologic map, at an appropriate scale, extending into adjacent areas, based on field mapping and air-photo interpretation, will be produced for each resource area. The map will also depict all known major structure or trends as well as surface geothermal manifestations. Cross-sections based on available geologic data will be drawn through the resource areas so that a three-dimensional presentation can be made.

Besides black and white, color and color infrared (IR) photos, air-photo studies will involve the interpretation of SLAR, LANDSAT (ERTS), NATA U-2 and Apollo imagery, as available. Data obtained will be utilized to produce a lineament map for each of the resource areas.

Task 3 - Temperature Gradient Study

It is currently anticipated that a minimum of four (4) 500-foot (156 m) deep, heat flow holes be drilled in each resource area. However, site conditions may dictate that a lesser or greater number of such holes be drilled. It is contemplated that the heat holes should not be any deeper than that expressed above, but there may be a possibility that intermediate depth gradient holes, up to 2,000 feet, may be a necessity.

A suite of logs will be taken in each heat flow hole including temperature, resistivity, self-potential, and natural gamma. Whatever "scrounge" holes may be located within the resource areas; i.e., water wells, oil-test wells, mineral exploratory holes, etc., temperature gradients will be measured for these holes. These data will complement that obtained from the heat flow holes.

ARTICLE II - DESCRIPTION OF RESPONSIBILITIES (Cont'd)

Two sites will be investigated during the initial term of the Agreement. These include the La Grande and Lakeview areas. A third site, the Ontario area, will be studied for possible inclusion into this task.

Task 4 - Geochemistry

During the Phase I investigation, available thermal springs and wells in Oregon were sampled, water analyses determined, and geothermometry computed. This process will continue for the resource areas for additional wells and springs that may not have been included in the previous study by virtue of their availability. If thermal or saline fluids are encountered in the heat flow holes, samples of these fluids obtained by either wire-line sampling gear or drill stem testing will undergo chemical analyses and geothermometric evaluation. These data also will be submitted to the USGS, Menlo Park, California, for their inclusion in the GEOTHERM data base.

The Participant is also responsible for cost-sharing to the extent provided for in Article III, "Financial Support of the Project."

ARTICLE III - FINANCIAL SUPPORT OF THE PROJECT

A. The total estimated cost of performing the work under this Agreement is Two Hundred Fifty-Seven Thousand Two Hundred Twenty-Six Dollars (\$257,226.00) including One Hundred Thirty-Six Thousand Dollars (\$136,000.00) authorized by pre-contract cost letter. The Participant shall be reimbursed by DOE for not more than 90% of the costs of the project determined to be allowable in accordance with Article A-I of the General Provisions entitled "Allowable Costs." The remaining 10% or more of the costs of the project so determined shall constitute the Participant's share for which it will not be reimbursed by DOE. The total cost to DOE is hereby established as Two Hundred Thirty-One Thousand Four Hundred Ninety-One Dollars (\$231,491.00), and this amount is also the maximum amount of the project which is subject to reimbursement by DOE unless such maximum cost is changed in writing by the Contracting Officer.

B. In regard to any increase or decrease in the total estimated cost of this Agreement, as a result of any change in the original Statement of Work, as may be agreed upon by the parties during the term of this Agreement, the appropriate sharing of the funding, if any, of such increase or decrease shall be shared at the ratio of 90% DOE, 10% Participant,, as agreed upon above.

C. The amount of funds obligated under this Agreement by DOE for the period from May 23, 1979 through December 31, 1980 is Two Hundred Thirty-One Thousand Four Hundred Ninety-One Dollars (\$231,491.00). Funding for continuation of the project in future years will be provided when and if available.