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MEMORANDUM

February 25, 1985

TO: Susan Prestwich

FROM: Mike Wright and Wil Forsberg

SUBJECT: UURI Cascades Needs Now to 31 March

1. We estimate that we will need $20,000 in Cascades through the end of March. Tasks include:

   (a) collection of available geological, geochemical and geophysical data base

   (b) starting interpretation and integration of data base

   (c) planning field work for summer research

   (d) analyses of applicability of geophysical techniques to Cascades exploration problems

2. We presently plan the following split on injection research:

Tracer Development	$135,000
Field Program	25,000
Geophysical Techniques	40,000
	$200,000

Cascades

Proposed Division		Actual Division ~~with complete FY85~~	
Tech Assistance	218,405	Tech Assist	208,000
Geoph studies	84,885	Geoph studies	65,500
Magma Chambers	47,710	Magma Chambers	46,500
	351,000		320,000
Available	320,000		
	<31,000>		

	Now to End FY85	Left for FY86	Now to March 31
Tech Assist	90,000	118,000	7,000
Geoph studies	45,000	20,500	3,200
Magma Chambers	40,000	6,500	2,000
	175,000	145,000	12,500
		125,000 FY86 expected	
		245,000	

Sibbett – 8mo 63K

1. Support for Meager slpt + hydraulic model + Hawaii, etc.
2. Loth Leg of Meager –

Through 31 Nov.

Injection	200,000
State	50,000
Cascades	175,000
SAN	200,000
Ascher	7,000
State carry	13,000
Spain	30,000
Ecuador	20,000
Los Azufres	50,000
Ocean	14,000
	$ 759 K

DOE $688 K 1 Oct 84 – 1 Dec 85

14 months

688/14 = $49,100

2.0 INTRODUCTION

The majority of the world's high temperature geothermal resources are closely associated with active volcanism. While there is little doubt that potent heat sources capable of driving large hydrothermal convective cells must also exist widely in the volcanically active Cascade Range, low permeabilities of the basement rocks and extensive near-surface cold water aquifers have made exploration difficult.

Nevertheless a variety of exploration techniques are currently being applied to the evaluation of geothermal systems in the Cascades. Most, however, have met with limited or guarded success. To a significant extent we believe that this reflects the complexity of these thermal systems and the lack of well-documented exploration models, particularly with respect to the character and distribution of the thermal fluids at depth, which ultimately determine both the geophysical and geochemical responses of the rock.

Chemistry and Distribution of Thermal Waters in Volcanic Systems

Geothermal fluids in volcanic terranes, such as the Cascades, frequently range in composition from acid sulphate to near neutral sodium bicarbonate/sulphate and sodium chloride. The application of geochemical thermometry to these waters, however, commonly yields results that are in apparent conflict with predicted and measured temperatures obtained using other methods. One possible explanation has recently been proposed by Mahon and others (1980)[1]. Their model, based on studies of New Zealand and

[1] Mahon, W. A. J., Klyen, L. E., Rohde, M., 1980, Neutral sodium sulphate bicarbonate waters: Journal of the Japan Geothermal Energy Association, 17(1), p. 11-24.

The Meager Creek geothermal system in British Columbia has been the site of intense exploration efforts since the mid 1970's. ESL/UURI scientists have conducted geochemical, geophysical and mineralogical studies of the core and cuttings from ~~the several of the shallow~~ many of the ~~deep and~~ wells. The results of these studies indicate that significant differences exist between productive volcanic related fields located outside of the U.S and Canada and those of the ~~Cascade~~ Cascade and Garibaldi Volcanic Belts ~~here~~.

The aims of the work we propose are twofold: First, we propose to incorporate the chemical and geologic data into a conceptual ~~working~~ model of the Meager Creek thermal system. We believe this model ~~would~~ will have broad application to other systems in the Cascades.

Secondly, we propose to ~~examine~~ compare and contrast the characteristics of the Meager Creek system ~~with~~ with other ~~volcan~~ well documented volcanic related systems. This will allow us to better evaluate the effectiveness and limitations of various exploration techniques currently in use.

8 U84
12 BY4

Many needs Nows till end March

Injection
Cascades - $320K

Tracer Dev	85,700 →	$135,000
~~Fis Division~~ Field Expl	55,820	25,000
Geoph	80,000	40,000
	191,520	200,000

Cascades

Tech Asst		214,880		208,315 ← Bruce nos till Mar
Gp	20 days PW	84,567		65,000 ←
Moquah		46,685	→	46,685 ← Week
		346,132		
		320		

26,132

320

820
20
20

860

Monthly Expenditures 2-27-85

1984	K$ DOE/ID	K$ DOE/SAN	K$ Total
July	13.	28	41
Aug	20	33	53
Sept	22	26	48
Oct	~~50~~ 48	35	83
Nov	~~23~~ 21	23	44
Dec	26	16	42
~~[illegible]~~ Total	150	161	311
Avg.	25	27	52

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MEMORANDUM

May 29, 1985

TO: Mike Adams, Duncan Foley, Joe Moore, Dennis Nielson, Howard Ross, Bruce Sibbett, Phil Wannamaker

FROM: Mike Wright

SUBJECT: Cascades Research Meeting

Let's get together on Thursday, May 30 at 1300 hours for a second Cascades meeting. The objectives and products of this meeting will be:

1. A review of what was learned by those attending the USGS Cascades workshop

2. Identification of gaps in the current understanding of Cascades geothermal systems

3. A discussion of the Cascades CSDP proposal that is being coordinated by George Priest

4. Formulation of a well-thought out program of Cascades research at UURI

5. Agreements about who shall do what in our work in the Cascades, and

6. A statement of work that I can submit to DOE-ID for their blessing regarding our plans

The following budgets are illustrative of what we can afford to do from now until 1 January 86 on the estimated $200,000 remaining in our budget. Foley is not included herein because I assume any Cascades work he does would be chargeable to State Coupled under technical assistance to Oregon. Wannamaker is not included because it is doubtful that we will get any MT data, but if his help is needed, time could be traded with someone. These budgets are illustrative only, they may be modified as our plans solidify, and they are an appropriate topic for discussion at the meeting.

ILLUSTRATIVE CASCADES BUDGETS

Technical Assistance

	Days	
Sibbett	100	
Nielson	10	
Moore	60	
Adams	40	
Ross	15	
Wright	20	
Sec/Drafting	30	
Technician	20	
Travel		$ 10,000
Geochem/X-ray		3,000
Miscellaneous		2,000
	Total	$120,000

Geophysical Studies

	Days	
Ross	20	
Wright	15	
Technician	20	
Sec/Drafting	15	
Travel		$ 3,000
Computer		2,000
Miscellaneous		7,000
	Total	$41,000

Geological Studies

	Days	
Nielson	45	
Sibbett	10	
Technician	10	
Sec/Drafting	15	
Travel		$ 4,000
Geochem/X-ray		3,000
Miscellaneous		2,000
	Total	$41,000

Grand Total $202,000

PMW/jp

cc: S. H. Ward
W. L. Forsberg

Cascades meeting 20 June 85

1. will be no audit on contracts (pre-award audits)
2. Progress payments based on milestones, not costs (in order to avoid audit).

Swabbing - figure 2 aquifers, swab after drilling as rods withdrawn

3. Sue wants core to come to UURI
will consider storing @ GS if its free

each time 1 day rig + ~~$~~500 for swab
= ~~[illegible]~~ rig cost $2650

allow ~~two~~ #3 aquifers swab each 24 hrs, 1 day contingency
$2650x3 + 3x$500 swab rental
7950 + 1500 = 9450

2 Swabs $10,000

For airlift 2 aquifers: 3 days rig, 3 days compressor rental @ ~~$1500~~ 1000
$11,000

if sand below aquifer being tested,
add 1 day rig + sand to each test

Sand = $(1/3)^2 \times \pi \times 1000 = 282 \text{ ft}^3$

÷ 13 ft³/ton = 22 tons sand + removal

$500 for delivery & removal

So 2 swabs

5 days rig + 5 days swab +

$520 for sand

13,250 rig time
2,500 swab rental
500 sand
16,200

For airlift 2 aquifers – add 5800 to airlift

So TPC –

(1) Swab two aquifers w/out Sanding 10,000
(2) airlift 2 aquifers w/out Sanding 11,000
(3) swab 2 aquifers w/ Sanding 16,000
(4) airlift " " " " 17,000

Meeting w/ Joe, Dennis, Howard — 8 May 84

1. variable cutoff if normal HF below near surface outflow -

2. DOE put up $150K, co can go as deep as it pleases w/ min expenditures except if both agree to cut off

3. Compile cost of drilling data independently to make sure.

4. How do you know when you're below "rain curtain"? Need to measure equilibrium temps

5. How much release of data?
will upflow data be released? - can it be put in RFP?
~~Wells~~ Holes already drilled avail?

6. Do we have a conflict of interest because of our x-ray work, geochem work for Union, Tsvei, Calif Energy, etc.

Our role

(1) well log interp

(2) mineralogy, geochem, mag susceptibility, density

(3) testing methods applie before drilling

(4) hydrology – w/ new student

⇒ (5) all aspects of tech assistance/contract monitoring.

Drilling

- Logging commercially done -- EG&G truck doesn't work right
- Logs ?
- DOE will not have final say, but needs to have tech rep on site to see that DOE gets what it needs. -
- "tech supervision of drilling program"

USGS – hydrology –

– regional geology

LBL – let them go out to Marty -- not support out of $400K.

Fluid Sampling — have to flow the hole — how to pay?

How to preserve holes — sealed as HF hole or open as sample hole — affects casing program — How to preserve for future scientific work —

Should drill 1-2 at a time, get good result rather than ~~speeding up to~~ committing to a certain # of holes —

maybe drill as deep as possible & preserve well, w/ sampling in out years

vs

getting complete suite of data now —

Be able to do H-P to detect water movement — hole must be left in such condition to do this objective → stimulate further industry development

Strategy – assume multiyear prog.
First year – drill as many wells to deepest depth possible – preserve for further work
Second year – select wells from first year for deepening and scientific work.
third & subseq – same – drill new wells –

well Diameter
Casing Program – lowest casing dia – 4" can be cored thru
Core vs Rotary
Splits of Samples –

Potential UURI Roles in Cascades Drilling Program

1. Evaluation of proposed sites

2. Logging of drill chips/core

3. On-site supervision of drilling operations including logging

4. Open filing and release of data

5. Member of Proposal Review Panel
   Nielson, Ross, Moore would be best combination

6. Supplementing data from sites as needed

7.

Other Big Player / States