

Geothermal Energy

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COORDINATION OF GEOTHERMAL RESEARCH

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## Coordination of Geothermal Research - April 1978

During the period 23-29 April, the Geothermal Coordinator visited several institutions in western Canada. The itinerary was as follows:

Mon 24 April	Dept. of Physics, University of Alberta, Edmonton
Tue 25 April a.m.	Geological Survey of Canada, Vancouver
p.m.	Dept. of Geophysics, University of B.C.
Wed 26 April a.m.	Symposium on Geothermal Energy, Vancouver
p.m.	Technical discussion of Meager Creek, at GSC.
Thur 27 April	Pacific Geoscience Centre, Victoria
Fri 28 April a.m.	British Columbia Hydro and Power Authority, Vancouver
p.m.	Geological Survey of Canada, Vancouver

### University of Alberta

Prof. F.W. Jones of the Dept. of Physics has prepared a submission to the Provincial Government for funding to carry out research into the geothermal potential of sedimentary formations in Alberta. Prof. Jones proposes to map the thermal character of the area and to make field measurements in available wells where necessary and feasible. This work will form a good continuation of our early review work by Sproule Associates Ltd., and will establish the continuing research in the Province of Alberta. Discussions between the Coordinator and Prof. Jones consisted of a review of the current state of research and a refinement of the submission.

University of British Columbia

The Coordinator gave a seminar on the current state of geothermal energy research in Canada.

Technical Discussion on Meager Creek

Following a series of formal papers at a symposium of the CIMM meeting, the principal scientists met at the office of the Geological Survey to discuss progress and future plans and to compare results. Present were: L.K. Law, J.G. Souther and A.M. Jessop of EMR; A. Nevin and J. Crandall of Nevin, Sadlier-Brown, Goodbrand Associates Ltd., J. Stauder and W. McCullough of B.C. Hydro, P. Read of Geotex Consultants Ltd., and Caroline Trimbell of VTN Inc., Los Angeles.

The meeting began with a review of all the reports and papers resulting from work at Meager Mountain. These are indicated by an asterisk in Appendix 1. Further reports, not yet publicly released will appear shortly. Nevin reviewed the results of the resistivity survey of 1977. Owing to a late start, this survey was restricted to a small square covering the confluence of Meager Creek and Pebble Creek with the Lillooet River. Preliminary maps of resistivity at -500, -1500, and -2500 m above sea level were shown. Resistivity contrasts were apparent, but interpretation must await the extension of the survey in 1978. There was some discussion of inferred faulting, but Read stated that such faults are not seen in detailed geological mapping.

Law described the results of audiomagneto-telluric studies and showed how this has revealed low resistivity zones within 10 km of the surface on two sides of the volcanic complex. AMT sites are more widely spread than the electrical survey and the depth of penetration is much greater for AMT. For

these reasons, direct comparison of the two methods is difficult until fill-in work is done.

Further AMT work within the area of the volcanic complex is planned for 1978.

The B.C. Hydro work during 1978, to be carried out by Nevin Sadlier-Brown Goodbrand Associates Ltd., consists of:

the extension of the resistivity survey as described above;

1200 m of percussion drilling, to a maximum depth of 60m, in the Meager Valley and the Lillooet Valley above Pebble Creek at sites accessible by road;

possibly two or three diamond drill holes, totalling 300 m, probably above the falls of the Lillooet River, where access is by helicopter.

It was understood that the logging road in the upper Lillooet Valley will not be extended further during 1978, but that the road in the Meager Valley will be continued beyond the hot springs.

#### Meeting at B.C. Hydro

B.C. Hydro called a meeting on Friday 28 April in order to see a film and a slide presentation on drilling at Roosevelt Hot Spring, Utah, By O'Brien Mines. The Coordinator attended from EMR. The presentation was by R. Korman of O'Brien Mines and E.V. Ciancanelli, consulting geologist. This particular well is one of the best potential producing wells ever drilled, and is expected to supply steam for the generation of 12.5 MW of electrical power. Since steam was encountered at a very shallow depth, control of the well was very difficult and four men were scalded during drilling. The total depth was 380 m and the cost was M\$1.1, of which K\$250. was for drilling mud. This extremely high cost was the result of encountering high-pressure at shallow

depth, where mud weight was insufficient to control the well. Snubbing gear was used on the well, with its attendant loss of time on all operations, but this seemed to be the only way to avoid dangerous blow-outs and hazard to the drill crew.

The two speakers had visited Meager Mountain on the previous day and were reported to have formed favourable impressions of the geothermal potential on the basis of visible geological evidence.

#### DEMR Contracts and Contributions during 1978-79

Although no meeting was called to deal specifically with EMR activities during 1978-79, the Coordinator reviewed the planned activities with EMR scientists on several occasions. The drilling of the deep well at Regina is, in financial terms, ten times larger than any previous project and thirty times larger than average projects. Consequently, uncertainties in the expected costs are as large as most complete projects, and since the true costs will not be known until October, it will be impossible to use surplus funds in field operations. It may be possible to use surplus funds on analysis technique studies as in 2.1 below, or in shallow drilling for temperature gradient in the Coryelle Syenite if contracts can be arranged quickly.

The project now in preparation are as follows:

1. Regional Geothermal Anomalies
  - 1.1 Detailed mapping (1:500,000) of one or more plutons of the Coryelle Syenite, including sampling for -ray analysis. These intrusive rocks are of Eocene age and are known to be rich in heat producing elements. They are potential areas of hot dry rock resources. Hot springs in the area indicate high thermal gradients, but hydrothermal systems are unlikely. Souther will look for possible contractor.  
Estimated cost K\$10.

- 1.2 Drilling of Coryelle Syenite for temperature gradient observations. Drilling to about 200 m of one or two sites chosen during the mapping of project 1.1 could be done in the autumn if costs at Regina permit. Sites would need to be selected for easy access, even after early snowfall, in central parts of the plutons in competent unfractured rock and in areas of moderate topographic relief. No action needed now. Estimated cost K\$20-50.
- 1.3 Detailed mapping in Franklin Glacier Complex. This project of 1977-78 remains incomplete owing to the failure of the contractor to submit the final report on time. Remaining cost K\$2.
- 1.4 Sampling of water for chemical and isotope analysis, and sampling of rock for analysis of thermal properties and mineralogical studies. To be used in small amounts as required. Estimated cost K\$1.5.
- 1.5 Detailed mapping of Mount Cayley. This volcanic centre is similar to Meager Mountain. Drilling in 1977 encountered warm water. The Mountain is easily accessible from both sides. This should be done in late summer if costs at Regina permit. Peter Read, who did an excellent mapping job on Meager Mountain is not available due to other commitments and it may be difficult to find a sufficiently experienced contractor. Souther will look for possible contractors. Estimated cost K\$20.

No further age-dating of volcanic rock is planned, since work was accelerated in 1977-78.

In summary:

To go ahead:

1.1 Mapping of Coryelle Syenite	K\$ 10
1.3 Mapping of Franklin Glacier Complex	K\$ 2
1.4 Sampling of spring water	<u>K\$ 1.5</u>
	K\$ 23.5

To wait until 1979

1.2 Drilling of Coryelle Syenite	K\$ 20-50
1.5 Mapping of Mt. Cayley	K\$ 20

2. Assessment of Resources

- 2.1 Magneto-telluric soundings on Meager Mountain. Soundings will be made of four points, accessible only by helicopter, on ridges that provide reasonable space for deploying equipment. Sites chosen lie between areas of conductive anomaly indicated by work of 1977. Interpretation will include consideration of errors due to severe topographic relief. Law will proceed to set up contract. Estimated cost K\$24.
- 2.2 Mercury vapour survey of reservoir areas. This technique has been used extensively in the USA as an indicator of high subsurface temperatures. A trial survey is proposed for the area indicated by resistivity anomalies. Souther will look for possible contractor. Estimated cost K\$5.
- 2.3 Radon survey of reservoir areas. This technique is also used in reservoir areas and possibly could be combined with the mercury survey. Lewis and Souther will discuss arrangements. Estimated cost K\$10.

2.4 Isotope analysis of hot spring water. Continuation of studies by University of Waterloo. Report of 1977-78 activities has only just been received and Souther will assess need for further work.

Estimated cost K\$3.

2.5 Shallow drilling for thermal measurement. The encouraging results of drilling in 1977 indicate that further drilling should be done close to Meager Mountain, on the north side to be as close as possible to the most recent eruptive vents. This project is regarded as an important part of the process of locating a deep drilling target. It is planned to do this work in 1979-80. Estimated cost K\$50-60.

No further shallow seismic studies are planned.

In summary

To go ahead:

2.1 Magneto-telluric survey at Meager Mt.	K\$ 25
2.2 Mercury vapour survey	K\$ 5
2.3 Radon survey	K\$ 10
2.4 Isotope analysis	<u>K\$ 3</u>
	K\$ 43

To wait until 1979

2.5	Diamond drilling on north side of Meager Mt.	K\$50-60
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3. Sedimentary basins.
- 3.1 Drilling at Regina. The well to confirm the predicted temperature and production rates of water for the Winnipeg and Deadwood formations is to be drilled on the campus of the University. This well will also be used as the production well of a circulating pair. Drilling will be financed by a contribution to the University of Regina of K\$655.
- 3.2 Contingency fund for drilling at Regina K\$ 25
- 3.3 Measurement of thermal properties of rocks and cuttings from Regina well, to be done at the University of Saskatchewan, Saskatoon. Costs will probably be reduced by combining with other programmes to share setting up costs, but provisionally estimated at K\$12 maximum.
- 3.4 Data gathering contract by Sproule Associates. Completion of contract began in 1977-78. Remaining estimated cost K\$ 14

In summary

To go ahead:

3.1 Drilling at Regina	K\$655
3.3 Thermal properties of rocks	K\$ 12
3.4 Data gathering contact	<u>K\$ 14</u>
	K\$681

In reserve

3.2 Contingency fund for drilling	K\$ 25
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The total planned activities for 1978-79 are thus:

1. Regional Geothermal Anomalies	K\$ 23.5
2. Assessment of Resources	K\$ 43
3. Sedimentary Basins	<u>K\$681</u>
	K\$747.5
Contingency fund for Regina	K\$ 25
Travel etc.	<u>K\$ 22</u>
	K\$794.5
Total funds available	K\$780

The discrepancy between these figures, which amounts to less than 2%, will be resolved through the year by variations between actual and estimated costs, and if necessary by adjusting one or more projects. I do not regard this as a serious problem, but rather as an indication that we intend to make the maximum possible use of the funds that we have requested. Everyone letting contracts for geothermal energy R&D should check with the coordinator before final signing of contracts, so that the total expenditure for 1978-79 does not exceed K\$780.

#### Post-script

After completion of this report, changes in our funding have been suggested by the Renewable Energy Resources Branch. At this extremely late date it is unlikely that large changes can be made for 1978-79. A further report will be prepared when the situation is clarified.

Appendix 1. Canadian reports and papers on geothermal energy.

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UTILIZATION OF GEOTHERMAL ENERGY.  
UNIV. TORONTO, INST. AEROSPACE STUDIES, REVIEW 40, 21PP, 1976.

HAINES, P.J. AND JESSOP, A.M.  
GEOTHERMAL POTENTIAL AND GEOTHERMAL EXPLORATION IN THE CARIBBEAN  
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CANADIAN INTERNATIONAL DEVELOPMENT AGENCY, 30PP, 1975.

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GEOCHEMISTRY OF THERMAL WATERS IN THE MOUNT MEAGER HOTSPRINGS AREA,  
BRITISH COLUMBIA.  
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GEOTHERMAL SERIES, EARTH PHYSICS BR., NO. 8, 10PP, 1976.

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GEOTHERMAL SERIES, EARTH PHYSICS BR., NC. 9, 17PP., 1978.

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SEISMIC REFRACTION STUDY IN THE MEAGER MOUNTAIN GEOTHERMAL REGION,  
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CANADA - EARLY STAGES OF GEOTHERMAL INVESTIGATION IN BRITISH COLUMBIA.  
PROC. U.N. SYMP. GEOTHERMAL RES., SAN FRANCISCO, 1161-1165, 1975.

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REPT. TO B.C. HYDRO AND POWER AUTHORITY, 18PP. + DIAGR. + APPEND., 1975.

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