

Item by 567

Geothermal Energy

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COORDINATION OF GEOTHERMAL RESEARCH

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Division of Seismology and Geothermal Studies

Earth Physics Branch

Department of Energy, Mines and Resources

1980

The Geothermal Coordinator visited several institutes in western Canada during the period 27 October to 11 November 1980. This was the first coordinating visit to the West since May 1980, it coincided with the announcement of the new National Energy Policy, and it revealed a number of maturing summer projects and new ideas for future work, which will be recounted throughout this report.

Just prior to this visit the Postdoctoral Fellowship of Jacek Majorowicz reached its natural conclusion, and he has returned to his home in Warsaw, Poland. During two years Dr. Majorowicz was able to interpret the available temperature data from the Prairies in terms of slow water migration and water-borne heat flow in the sedimentary rocks. This has given a better understanding of the thermal state of the sedimentary formations, and has provided a basic explanation for the observed contrasts in geothermal gradient. A paper entitled 'Regional heat flow patterns in the Western Canadian Sedimentary Basin' has been accepted for publication by 'Tectonophysics', and a paper entitled 'Present heat flow and a preliminary history of the Central Prairies Basin, Canada' has been submitted to 'Geothermics'. We are fortunate to have obtained the services of Dr. Majorowicz, through the Postdoctoral Fellowship system, to perform this valuable scientific interpretation of the contractually acquired data.

Regina

The Geothermal Coordinator visited Regina on 28 October 1981. At this time the final approval of the second, reinjection well, funded by Federal-Provincial Agreement, was not completed by the Provincial Treasury Board.

A proposal to drill the reinjection well and to perform other associated engineering work was submitted by the University of Regina to the Government of Saskatchewan in the Spring. This proposal was transmitted to CREB and the Geothermal coordinator was asked for comments by way of the Renewable Energy Coordinator at NRC. The proposal seemed to be well constructed and clearly stated, and the intention was to drill the second well during the period August to October 1980.

Unfortunately, the unforeseen length of the administrative processes has prevented the drilling as planned, and it is not now possible to guarantee to complete the drilling during the current financial year. It is now hoped that drilling will take place during May-June 1981.

It was understood from Prof. Vigrass and Dean Blatchford that the Saskatchewan Universities Commission has assigned a low priority to the sports complex that is intended as the heat load for the geothermal system. The President of the University, Dr. Barber, was not present, and it was not possible to obtain his thoughts on this situation. One alternative scheme involves the use of heat pumps to upgrade the energy to match the existing steam system of the rest of the University. Prof. Vigrass has already made preliminary enquiries along these lines.

The publication of results of measurements and observations of the first well was discussed. The tentative plan is to produce a package of four papers, for possible publication in the Canadian Journal of Earth Sciences. These will deal with:

- 1) an overview of the project;
- 2) the thermal aspects;
- 3) the hydrological aspects; and
- 4) the geochemical aspects;

A paper on the hydrofracture experiment, jointly authored by members of the University of Toronto and EMR is also in preparation.

Edmonton

The Geothermal Coordinator visited Edmonton on 29-30 October, spending most of the time with Prof. F.W. Jones of the University of Alberta.

Prof. Jones is in the process of setting up a divided bar system to obtain measurements of thermal conductivity of sedimentary rocks from the Prairies. Because he had long experience of such measurements at the Earth Physics Branch, the Coordinator was able to provide extensive advice on the construction and operation of this equipment. A research assistant has recently joined the Dept. of Physics to superintend the project. Prof. Jones enquired about the possibility of support for this project for the second half of the financial year 1981-82. Since the project fits excellently with studies at the Earth Physics Branch, including the net-rock analysis contract now under way, it was suggested that he should submit a proposal for this work, and he agreed to do this.

Prof. Jones is not interested in a service contract to provide routine measurements for the Geothermal Service.

The collection of temperature data from oil-well files is progressing well. About 14,000 data are now on file, all from areas north of about Township 40. The project will be completed during the current academic year and is expected to contain a total of 20,000 data. Some interesting

patterns and anomalies are emerging. Ways of mapping and displaying the data were discussed. It was concluded that, given such a large data set and considering the variability of data quality and the complex geological setting, several map formats must be used. For example, one can use:

- map of average temperature gradient to basement;
- map of average temperature gradient to any specific formation;
- map of temperature at any depth below surface;
- map of temperature at any specific elevation;
- map of temperature in any formation or aquifer;

and many others.

Beyond the presentation of temperature data comes the combination of temperature with conductivity and lithology to provide a thorough understanding of the thermal regime, to provide the ability to distinguish between conducted and water-borne heat flow, and to determine the most favourable areas for exploitation of geothermal energy.

The Coordinator visited Douglas McDonald of the Alberta Department of Energy and Natural Resources. This Department has been supporting the temperature data compilation project, but since the current support is in the last of three years, they are interested in seeing some conclusions or knowing the next step. I tried to explain my concept of the continuing path. Mr. McDonald seemed to be sympathetic in general to the object of defining the geothermal resources of Alberta: he regards them as uneconomic in the context of present natural gas prices, but he acknowledges that this base of comparison will shift in the near future.

In order to plan future work, it was agreed with Prof. Jones that the Coordinator would attempt to convene a second meeting of the people that met in Regina at the time of the drilling on 29 January 1979. These

were: Prof. Vigrass, University of Regina; Prof. King, University of Saskatchewan; Prof. Jones, University of Alberta; J. Stauder, B.C. Hydro, A. Judge and A. Jessop, Earth Physics Branch, E.M.R. These and others will be contacted to determine interest in a second meeting. New participants may be from the Provincial Governments concerned and the Institute of Sedimentary and Petroleum Geology. The objectives of a second meeting will be: to review the progress so far of research and development aimed at exploitation of sedimentary geothermal resources; to determine the path to be followed; to identify the possible active research centres; and to identify the possible sources of funding support. Such a meeting, if it seems to be generally desired, may take place at the University of Alberta during the first week of February. The Coordinator agreed to prepare a document to show his conception of the future course of research, to be used as a discussion paper.

Vancouver and Victoria

The Geothermal Coordinator visited Vancouver and Victoria during the period 3 - 10 November 1980.

With the exception of the detailed surface mapping of the Coryell syenite area, all projects in British Columbia are well advanced. Most field operations are completed and results are being analysed. The drilling project at Mt. Cayley had been expanded to a second hole, in order to follow up on the successful results of the first hole. This was made possible by underexpenditures elsewhere, particularly on the Coryell project. The two holes encountered temperature gradients of 105 mK/m and 63 mK/m, the first being closer to the volcanic centre. The drilling was concluded on 8 November. Geological mapping in 1979, which revealed several volcanic domes, and a small resistivity experiment

of 1980, which has detected anomalies near two of these domes, combined with the results of the drilling indicate that Mt. Cayley is as good a geothermal prospect as Mt. Meager. During 1981 some work will be directed towards an examination of the areas between the two volcanic centres, to determine the extension of the anomalies along the axis of the volcanic belt. The distance between the centres is about 60 km, but the terrain is rugged and the area is difficult of access.

The drilling project in the Tertiary basins of the Okanagan area was progressing satisfactorily, without the impending snowfall of the Coast Range to limit the field season. The present drilling is located in crystalline rock at the edge of the two selected basins, in order to establish a background thermal gradient for the area, free from any masking effect of water flow in the sedimentary rocks.

With T.J. Lewis, the Coordinator visited E. Grove and N. Church of the Ministry of Energy, Mines and Petroleum Resources (MEMPR) in Victoria. There is growing interest in geothermal potential of the Tertiary basins among MEMPR scientists, and they have submitted an item of \$245,000 for drilling to their estimates for 1981-82. This item is not yet approved. / It is very encouraging to see this interest within MEMPR, and scientists of the two departments will continue to maintain close contacts. It was decided that priority should be given to the area bounded approximately by 118-122°W, 49-51°N, where most of the population of the British Columbia Interior is situated. Within this area the first experiments will be concentrated in the Okanagan area

There are two geological features of direct interest. One of these is the series of small Tertiary sedimentary basins, which may hold water of exploitable quantity and temperature, and the second is the presence

of potassium-rich intrusive material, of which the Coryell syenite is the largest surface expression. Coryell-type material is known to outcrop and is detected by drilling over a wide area of British Columbia, including most of the rectangle defined above. The thickness, continuity and heat production are unknown, but if this material exists below sedimentary rocks, there may be aquifers of above-normal temperature.

While waiting for the B.C. Hydro meeting on 10 November the Coordinator visited drill camps at both Mt. Cayley and Meager Creek in order to correct problems in the temperature logging equipment. On this occasion problems turned out to be minor and to have been caused, at Meager Creek, by the recent extremely wet weather. During the 1980 drilling season, B.C. Hydro and their contractor have lost one probe and have broken and recovered the teflon-coated cable of the high-temperature logging system. The loss of one probe is not excessive, considering the amount of use made of the equipment. The breakage of the teflon-coated cable was probably due to high viscous drag in the drilling mud used by B.C. Hydro drill crews. The supply and maintenance of temperature-measuring equipment to the Meager project and other projects represents a considerable investment of technical work by the Geothermal Service, which is likely to increase if MEMPR begin a drilling project in the Tertiary basins.

B.C. Hydro

The second meeting of the Meager Mt. Project Steering Committee was held at the office of B.C. Hydro on 10 November 1980. J. Souther and A. Jessop were present for E.M.R.

Progress and results of drilling were reported, with reference to Fig. 1, as follows:

- M7 - drilled in 1979. Temp. 202° at 367m
- M8 - test of western boundary. Gradients 130-140 mK/m
- M9 - to be stopped shortly. Temp. 101°C at 1100m
- M10- next site for big rig. Temp 70°C at 128m
- M11- test of eastern boundary. Temp. 55°C at 560m
- M12- test of southern extension. Temp. 31°C at 337m
- L2 - drilling at 240m - no data available
- L3 - recently started

The prefix M signifies a location in the Meager Valley on the south side of the volcanic complex, and L signifies a location in the Lillooet Valley on the north side. The road to the north side, with a bridge over the Lillooet River has recently been completed.

The results of M9 are somewhat disappointing, particularly since the well took so long to drill. However M10, drilled so far by the small rig seems to be very promising. Surface casing has been set in this well, and the big rig will be moved on to it before winter closure. It is hoped to start drilling again in February or March, before the thaw but after the worst of the snow fall.

R. Durie of MEMPR reported that the Provincial Geothermal Act is to be amended, but that it may not be completed in the current session of the legislature. It is intended to deal with exploration rights, leasing rights and drilling regulation.

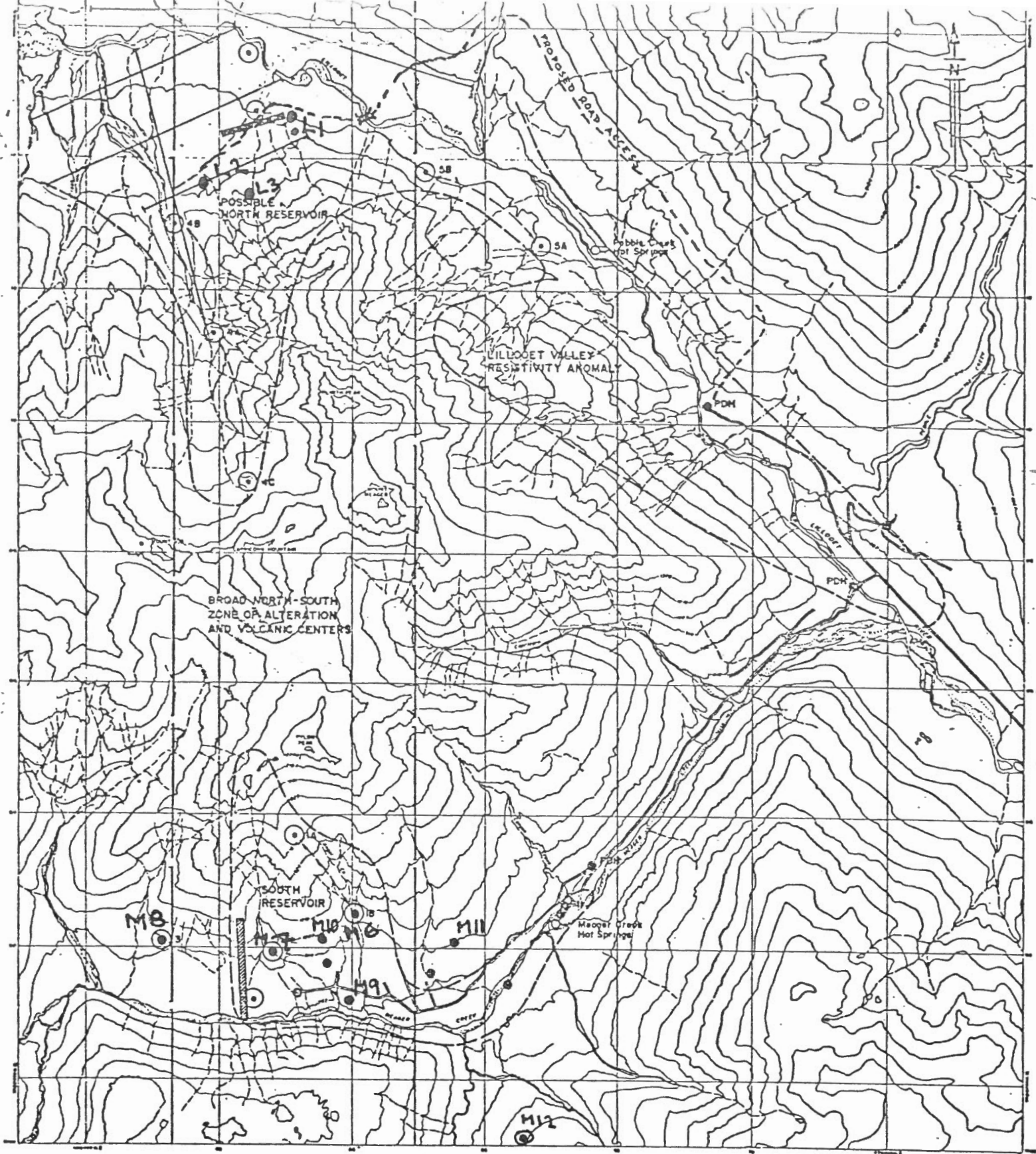
The budget for 1981-82 was presented as follows (in \$1000 units):

continuation of exploratory drilling	980.
Proving well	2680.
Environmental work	120.
Camp	<u>300.</u>
TOTAL	4080.

This budget is subject to the approval process within B.C. Hydro. They know that they cannot expect any further support from the Federal-Provincial system, but they pointed out that this work still involves a significant risk that is not present in most of their resource development. R. Evans stated that, unlike some other Provinces, British Columbia is using all its Federal-Provincial funds and that there is no possibility of further funding from that source. B.C. Hydro would naturally like some Government assistance, but it is the Coordinators impression that they will proceed with the project at least to the proving well.

A report of the meeting will be prepared by B.C. Hydro.

Since the Federal-Provincial assistance is to end, this was probably the last meeting of this Steering Committee apart from possible review activities after 31 March 1981. However, it is recommended that close technical cooperation between B.C. Hydro and E.M.R. be allowed to continue, particularly involving J.G. Souther (GSC) and T.J. Lewis (EPB), who are conveniently located to contribute their particular skills and experience.



0 1000 2000 3000 4000 METERS

LEGEND

-  Potential Geothermal Reservoir Areas
-  Hot Springs
-  Dipole-Dipole Resistivity Anomaly (Possible North Reservoir)
-  Western Resistivity Cut-Off (South Reservoir)
-  Existing Research Well (PDM = Percussion Drill Hole)
-  Proposed Research Well Site (Alternates shown with dashed arrows)
-  Proposed Resistivity (Dipole-Dipole)



Fig.1
Sites of geothermal drilling at Mt. Meager