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Geothermal Energy

June - July 1978

COORDINATION OF GEOTHERMAL RESEARCH

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Coordination of Geothermal Research - June-July 1978

The Geothermal Coordinator visited Vancouver on 5-6 June in response to requests by the Renewable Energy Resources Branch. During this visit an agreement was reached with B.C. Hydro for cooperative work in the Meager Mountain area during the present field season. A second visit to Vancouver was made on 4-5 July to discuss administrative and technical details of the work, followed by a visit to Regina on 6-7 July to review progress on the geothermal demonstration project on the University campus.

Vancouver - The June Meetings

In the first days of June it became apparent that funds could be made available for work in British Columbia at a higher level than had been planned. This resulted in a visit by the Coordinator to Vancouver on 5-6 June, for discussions with B.C. Hydro. At that time B.C. Hydro were considering dropping their geothermal programme for 1978 as an economy measure, despite its relatively small scale. Their planned expenditures had been K\$400. The Coordinator, on behalf of EMR, proposed that certain technical elements should be added to the B.C. Hydro programme and that the total cost of K\$500 should be shared. The finally agreed division was B.C. Hydro 60%, EMR 40%. Because of the very late change of plan by EMR and the fact that the field season was about to begin, it was impossible to arrange any formal cooperation between the two agencies. We were thus forced to let parallel contracts to the same geophysical consultant. This device is not regarded favourably by the scientists concerned, but is the only mechanism available when programmes are changed on such short notice.

The resulting contracts will be as follows:

B.C. Hydro	Environmental studies	K\$ 50	
	Geophysical studies	K\$250	Nevin, Sadlier-Brown,
EMR	Geophysical studies	K\$175	Goodbrand Ltd.
	Magnetotelluric survey	K\$ 25	Ecole Polytechnique

The magnetotelluric survey was already in the hands of DSS and it was best to allow the process of contracting to take its normal course. This survey is regarded as an integral part of the EMR share, for which a total of K\$200 is to be provided by EMR in addition to K\$780 previously provided for work in B.C. and the Prairies.

On return from Vancouver the Coordinator prepared a statement of work to be done as the EMR part of the geophysical studies. This was sent to the Renewable Energy Resources Branch (RERB), where it was attached to a requisition and set on to DSS. This contract and the magnetotelluric contract will be paid for by RERB and supervised by scientists of EPB and GSC.

Vancouver - The July Meetings

The coordinator visited Vancouver again on the 4-5 July 1978. On the 4 July a meeting was arranged between DSS and Nevin, Sadlier-Brown, Goodbrand Ltd. (NSBG), in order to discuss the terms of the EMR share of the geophysical work. This meeting took place at 2.00 pm on 4 July at the GSC, Vancouver, and was attended by A. Nevin, T. Sadlier-Brown and J. Crandall of NSBG, F. Thomas of DSS and J.G. Souther and A.M. Jessop of EMR.

Mr. Thomas explained very clearly to NSBG what was required of them in terms of estimates of cost, charges for manpower and documentary justification. The points where DSS and B.C. Hydro contracting practice may vary and the problems foreseen as a result of such variation were discussed. As a result of the meeting NSBG undertook to prepare a detailed cost estimate of the EMR share and to consult DSS further to minimize differences in accounting procedures required by B.C. Hydro and DSS.

Two meetings were held on 5 July. The first of these was held to discuss the possibility of cooperative ventures in future years and was attended by C. Guelke, J. Stauder, R. Scarth and P. Kadak of B.C. Hydro and J.G. Souther and A.M. Jessop of EMR. It was agreed that the working group proposed in June for the technical management of contracted operations at Meager Creek would be adopted. Subject to approval by management this working group will consist of J. Stauder and R. Scarth of B.C. Hydro and J.G. Souther and A.M. Jessop of EMR. J. Stauder and A.M. Jessop are the designated scientific authorities for contract administration by their respective agencies. B.C. Hydro would like to have a steering committee set up, to include management personnel of both agencies, one representative from each of the B.C. Ministry of Mines and the B.C. Energy Commission, and possibly one representative of each of B.C. Hydro and EMR from the working group. September was suggested for a first meeting of the steering committee. This committee will probably be set up as part of a Federal-Provincial package programme in renewable energy to be negotiated in September by RERB.

Skeleton plans for 1979 include a small effort in filling any clear deficiencies in the geophysical work and a thorough review of the results, including review and advice by experienced foreign experts. A deep

exploratory drilling programme is tentatively planned for 1980. Further development of this plan is now urgently required.

When questioned about work in other areas, B.C. Hydro expressed the intention of examining other sites, such as Cayley Mountain, that show evidence of geothermal potential. However, they showed no interest in taking part in any regional work. They seemed to be prepared to leave the data-gathering for the identification of sites to EMR. This is probably a realistic attitude, but the regional work does represent a further contribution by EMR to geothermal development that any negotiators may like to remember when assessing shares.

The second meeting of 5 July was a meeting of the working group with John Crandall of NSBG. The principals of the company were busy working out their submission to DSS. The timetable as then anticipated was:

- 5 July - Five men to Pebble Cr. to start setting up camp.
- 12 July - Camp complete, Cook, Fairbanks, Crandall and five field staff in camp.
- 14 July - Helicopter for preparation of landing pads; wire delivered
- 17 July - Deep Grid Analysis in camp, i.e. resistivity sub-contractor
- 19 July - Resistivity surveys begin
- 21 July - DSS approval of EMR portion; drilling out for tender.
- 7 Aug - Begin drilling

A second meeting of the working group was scheduled for 21 July, when the EMR Coordinator will be passing through Vancouver to the Geothermal Resources Council symposium. The weekend will be available for a visit to the camp.

Regina

On 6-7 July the Coordinator visited the Energy Research Unit of the University of Regina (ERU), in order to review progress on the geothermal demonstration project on the campus.

To the five invitations to drilling companies to tender for the drilling of the production well, only one positive response had been received. The other firms declined to offer a proposal. The one company that offered a bid proposed to use a drilling rig that was only marginally capable of completing the well. Prof. Vigrass had thus consulted the Saskatchewan Oil and Gas Corporation (SOGC) to discover if they could provide a rig.

A meeting was held at 10:00 on 6 July at the offices of SOGC between R. Craig, General Manager and B. Koeckeritz, Drilling Superintendent, of SOGC, D. Ruse, consultant for ERU, L. Vigrass and the Coordinator. SOGC propose to seek the use of a suitable rig, now in the Province of Saskatchewan and under long-term contract to Shell Oil of Canada Ltd. If this rig can be made available SOGC will provide drilling contractor services to ERU. Preliminary costs estimated by SOGC are in approximate agreement with original estimates for the purpose of the arrangement between the University of Saskatchewan and Energy Mines and Resources.

Later developments: SOGC were not able to obtain the use of the desired rig, but are now considering alternative arrangements. The equipment for drilling and the date of commencement are still unknown.

During the meeting many aspects of the drilling were discussed, including preparation and clean up of site, coring, testing, bit programmes, mud weights, casing and the fracturing experiment.

The chosen drill site, already marked by wooden stakes was visited to review access for equipment, the availability of water supply and the need for noise control. A legal survey of the site will be performed shortly.

A telephone call to J.C. Roegiers in Toronto confirmed that he had obtained bids for hydrofracture services and would be submitting a detailed cost estimate to ERU within a week, i.e. before 13 July.

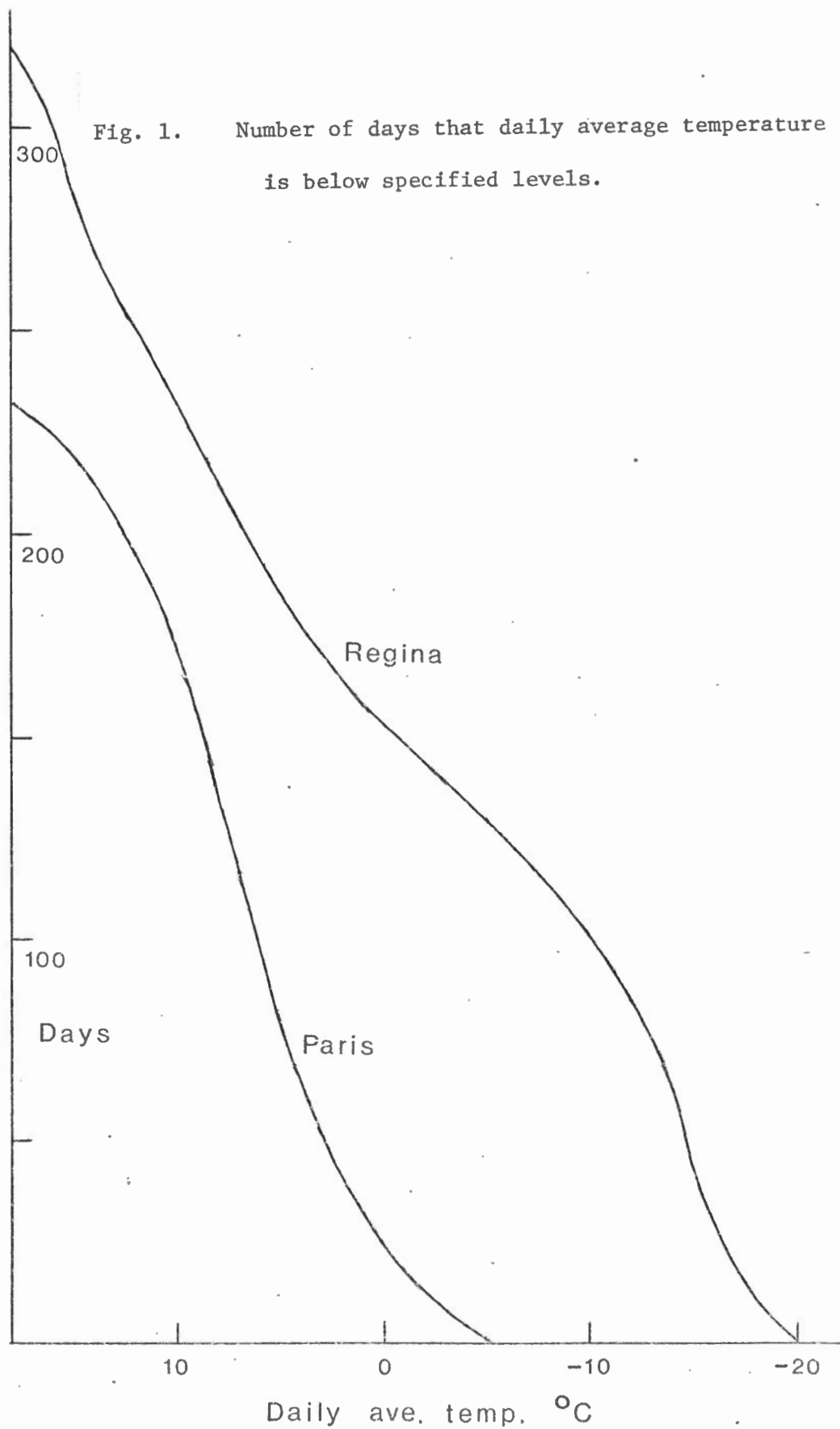
Later developments: the promised estimates were received in Regina and Ottawa on 12 July.

Prof. Vigrass is preparing a submission to the Dept. of Mineral Resources to carry out operations under the Oil and Gas Conservation Act, including drilling and water disposal. He will also apply to the Dept. of Environment, Groundwater Division, for a permit to test water flow rates. At the same time he will attempt to establish the permit requirements for producing water from deep formations. Although drill stem testing lies in the authority of the Dept. of Mineral Resources, any pumping tests are controlled by the Dept. of Environment. This detail is a good example of the legal difficulties that will hamper geothermal exploitation when it becomes common practice if controlling legislation is not enacted.

A meeting was held at the University at 14:00 to discuss the utilisation of the heat from the geothermal well. Present were L. Vigrass, D. Stewart and D. Vandenberghe of the engineering Dept., three graduate students and the Coordinator. Prof. Stewart is considering possible future uses of geothermal energy in conjunction with upgrading by solar inputs for industrial use. He is also considering the question of solar powered recharge of geothermal reservoirs. He has also considered wind turbines to provide pumping power, but the cost would be completely prohibitive.

Prof. Vandenberghe is working on the utilisation system for the geothermal water. Fig. 1 shows the climatic conditions compared with those of Paris, France, where similar geothermal systems are used. The climate in Regina is clearly much more severe than it is in Paris. Fig. 2 shows a preliminary concept of the heating system. The heat pump is shown only to indicate where it would be inserted if required. It is not anticipated that heat pumps will

Fig. 1. Number of days that daily average temperature is below specified levels.



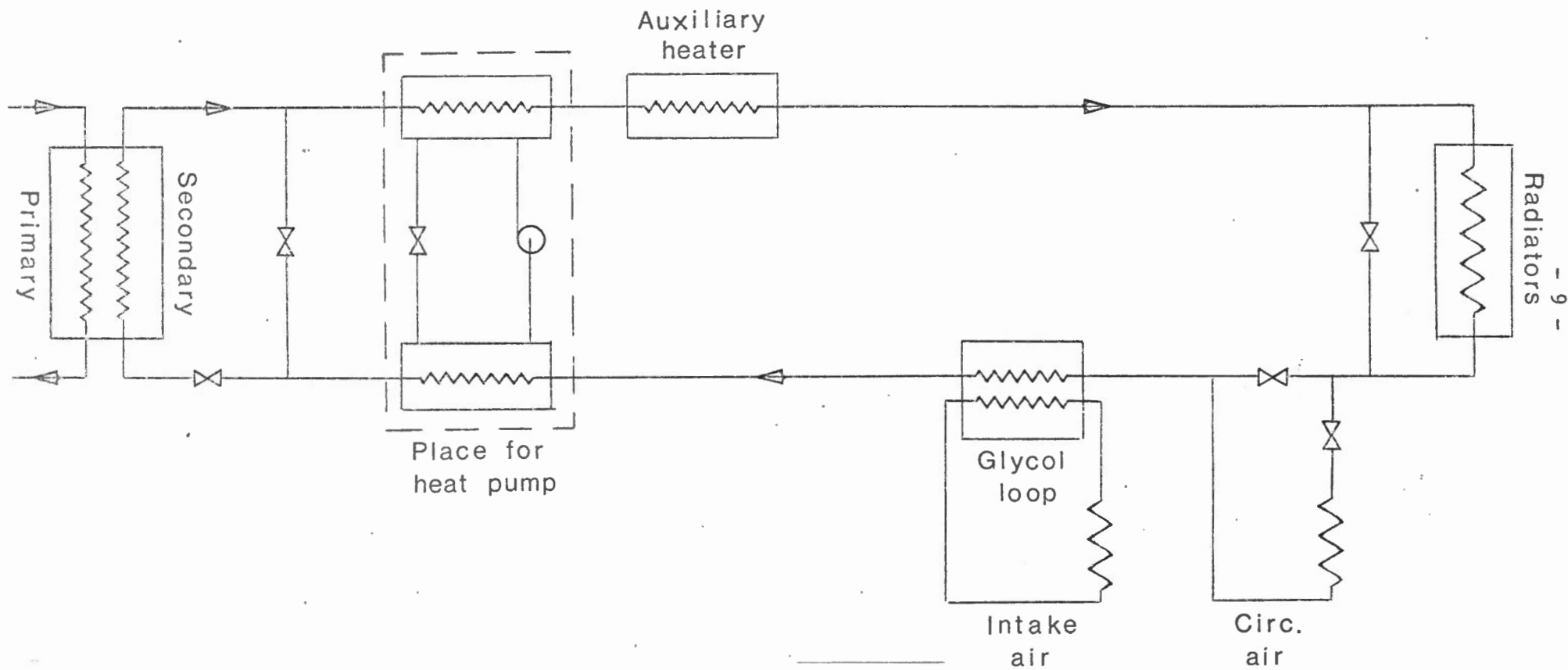


Fig. 2. Provisional plan for utilisation of geothermal water. The auxiliary heater is for emergencies only, and heat pumps are not expected to be economically useful.

be used, since the extra capital, maintenance and running costs involved are not likely to produce sufficient return. The auxiliary heater is for contingencies only and is not intended to be a necessary part of the continuing heating process. After passing through radiators and cooling to about 40° the water will pass through two air heating systems. The first of these will transfer heat to air circulating within the building, and the second will preheat intake air, using a glycol tertiary fluid heat exchange system. In extreme conditions this will raise the temperature of intake air from -40°C to perhaps -10°C and will reduce the temperature of the secondary system to about $+10^{\circ}\text{C}$. The primary water may thus be returned to the ground at about $+15^{\circ}\text{C}$, giving a total temperature drop of $55-60^{\circ}\text{C}$ in cold weather.

Other problems discussed were:

1. The removal of gasses, mainly small amounts of methane and carbon dioxide that are held in solution at reservoir pressure but will be released at surface pressure;
2. The change in Ph value of the water resulting from loss of carbon dioxide and possible resultant precipitation of calcium carbonate;
3. The possible occurrence of sulphate-reducing bacteria, which have been found to result in sulphide precipitation in some French systems. Some assistance from the Chemistry Dept. will be sought. It was decided that PVT testing would be appropriate, i.e. the acquisition of samples at formation pressure from the bottom of the hole. This will be done after the pumping tests, to ensure that the water in the hole is representative of the formation water and is as free as possible of contamination by drilling fluid. These tests, in addition to chemical analysis of samples taken during drill stem tests should provide all the necessary chemical information.

EMR Contracts and contributions during 1978-79

After the increase in available funds by K\$200 and further work by scientific colleagues, plans for 1978-79 are now as follows, where item numbers are taken from the Coordination report of April 1978 (Geothermal Service, Internal Report 78-5):

1. Regional anomalies
 - 1.1 Detailed mapping (1:500,000) of the plutons of the Coryelle Syenite. Sufficient existing knowledge of the area within the GSC has now been identified by J.G. Souther. It is considered that this item can be dispensed with at this stage, but larger-scale mapping of specific areas may be required later.
 - 1.2 Drilling of Coryelle Syenite for temperature observations. Given the present state of geological mapping, a clear indication of thermal anomaly is the first priority. The advent of extra funds for Meager Mountain makes it possible to reinstate this element for 1978.
 - 1.3 Detailed mapping of Franklin Glacier Complex. No change.
 - 1.4 Sampling of spring waters for isotope and chemical analysis. No change.
 - 1.5 Detailed mapping of Mount Cayley. No change.

In Summary:

To go ahead:

1.2	Drilling of Coryelle Syenite	K\$50
1.3	Mapping of Franklin Glacier Complex	K\$ 2
1.4	Sampling of spring water	<u>K\$ 1.5</u>
		K\$53.5

To wait until 1979 or until needed:

- | | | |
|-----|-----------------------------|-------|
| 1.1 | Mapping of Coryelle Syenite | K\$10 |
| 1.5 | Mapping of Mount Cayley | K\$20 |

2. Assessment of Resources

2.1 Magneto-telluric soundings on Meager Mountain. Proceeding as planned with funding responsibility transferred to RERB.

2.2 Mercury vapour survey

2.3 Radon survey

2.5 Shallow drilling at Meager Mountain. Three items combined into single contract with NSBG, as major part of EMR cooperative work with B.C.

Hydro. These items are combined into one and renumbered 2.6

2.4 Isotope analysis of hot spring water. No change.

2.6 EMR cooperative work with B.C. Hydro

In summary:

To go ahead:

- | | | |
|-----|---------------------------------------|---------------|
| 2.1 | Magneto-telluric survey of Meager Mt. | K\$ 25 |
| 2.4 | Isotope analysis | K\$ 3 |
| 2.6 | Combined surveys at Meager Mt. | <u>K\$175</u> |
| | | K\$203 |

Superseded

2.2 Mercury vapour survey

2.3 Radon survey

2.5 Shallow drilling for thermal measurements.

- 3. Sedimentary basins
 - 3.1 Drilling at Regina. No Change.
 - 3.2 Contingency fund for drilling at Regina. Reduced to K\$20.
 - 3.3 Measurement of thermal properties. No change.
 - 3.4 Data gathering by Sproule Associates. Work successfully completed and data package in hands of Coordinator. Final cost in 1978-79 was approx. K\$12 instead of the estimated K\$14.
 - 3.5 Processing of data generated by item 3.4. The conversion of lithological information to computer-compatible format in preparation for thermal analysis. To be prepared as a contract for the winter months, but only to be activated in 1978-79 if the contingency fund for the Regina drilling is not needed.
 - 3.6 Contribution to development of AFMAG system.

In summary:

To go ahead or completed:

3.1	Drilling at Regina	K\$655
3.3	Thermal properties	K\$ 12
3.4	Data gathering contract	K\$ 12
3.6	AFMAG system	<u>K\$ 5</u>
		K\$684

In reserve:

	3.2	Contingency fund for drilling] K\$ 20
or	3.5	Data processing contract	

Total activities:

The total planned activities for 1978-79 are thus:

1. Regional Geothermal anomalies	K\$ 53.5
2. Assessment of resources	K\$203
3. Sedimentary basins	K\$704
Travel etc.	<u>K\$ 22</u>
	K\$982.5
 Total funds available	 K\$980.

The discrepancy between these figures is now very small, and is well within the limits of error of estimates. Nevertheless, as requested in the previous report, all contract details should be reported to the Coordinator as they become available, and prior agreement of the Coordinator should be obtained for contracts that exceed these estimates.