

COORDINATION OF GEOTHERMAL RESEARCH

July 1982

Malcolm J. Drury

Crustal Studies

Division of Gravity, Geothermics and Geodynamics

Earth Physics Branch

1 Observatory Crescent

Ottawa, Canada

K1A 0Y3

Internal Report 82 -2

Between 21 and 23 July the author visited a contractor and provincial government personnel in Halifax and Fredericton to discuss the current status of the federal geothermal energy programme in Atlantic Canada. This brief report serves as a record of those meetings. The programme is now in its third year; all available data on underground temperatures, rock thermophysical properties and sedimentary basin hydrology have been compiled and presented in two reports by John A. Leslie and Associates Ltd. (JALA) Bedford N.S. (Leslie Report 1981; Leslie Report 1982).

July 21st, Halifax

On the afternoon of Wednesday the 21st, the author visited the offices of the Nova Scotia Department of Mines and Energy (NSDME). It had been hoped to see W. Potter, the director of the provincial energy programme, but unfortunately he was on vacation. He had not returned a telephone call the previous Monday when he had been in his office. P. Smith, who attended GERM in March 1982 as the N.S. representative, was in the field, and so the author spoke briefly to J. Watt. She had spoken to Jessop and Drury last January when they visited NSDME. A petroleum geologist, she maintained a certain interest in the geothermal programme. NSDME had done nothing about the programme, however; most of their geological and geophysical effort was being put into their offshore oil and gas programme. The author tactfully pointed out that it was difficult to know whom to meet at NSDME, as they seemed to delegate different people for every visit made by the federal scientists.

A copy of the Leslie Report 1982 was left with NSDME. It remains to be seen what use will be made of this report by NSDME.

July 22nd, Halifax

The author spent the whole of Thursday at the offices of JALA. An intended visit to Noval Technologies Ltd. was cancelled, as all their interested personnel had been called to a drilling site. This was unfortunate, as Noval have shown a great deal of interest in the exploitation of geothermal energy from sedimentary basins of the Atlantic region.

The discussions at JALA centred on their current data collection contract and the implications of the data obtained and presented in the Leslie Report 1982.

July 23rd, Fredericton

On Friday 23rd the author visited personnel of the New Brunswick Department of Natural Resources (NBDNR). First, the author talked to D. Gemmell, director of the provincial energy resources programme. Mr. Gemmell has maintained a strong interest in the geothermal programme; his attitude is extremely encouraging. The present status of the programme was discussed, and the author was informed of at least one deep (2500 m) borehole that is to be drilled later this year in the Moncton Basin, by Chevron-Irving. Further, Petrocanada plans to drill some 600 m holes in the Moncton Basin this year. Mr. Gemmell will keep JALA informed so that they can run temperature logs if possible.

The author then visited Mr. J. Chandra, a provincial geophysicist who has displayed considerable interest in the geothermal programme. Mr. Chandra asked if a proposal for federal funding prepared and submitted by NBDNR in 1981 had been shown to either the Geothermal Energy Programme Coordinator at EPB or to Drury. Drury said that neither person had seen the proposal. An earlier request had apparently been routed within EMR to the GSC, but it had never been shown to the geothermal energy personnel at EPB. Mr. Chandra provided a copy of the second proposal, which is attached as Appendix I.

The proposed EPB drilling programme for 1982 was then discussed. It is intended to have two 400 m holes drilled in different granitic batholiths (the Pokiok and the St. George), in areas identified as having anomalously high radiogenic heat production. Air photos and heat production maps were studied, and possible locations for the boreholes were identified on the basis of scientific merit and accessibility. In the Pokiok batholith, a hole will probably be drilled in the vicinity of Little Magaguadavic Lake (approximately 45° 20' N, 66° 30' W). Mr. Chandra undertook to check the accessibility of the sites.

Mr. Chandra has been asked by his director (Dr. J. Hamilton) to co-operate fully with the EPB programme. It is very welcome to meet such enthusiasm. However, during the course of the meeting, word came to Mr. Chandra of budget cuts by the provincial government. It is hoped that these will not dampen the enthusiasm.

The author had hoped to visit Dr. Hamilton, but a two hour delay due to fog at Halifax airport prevented such a visit on this occasion. Dr. Hamilton will be kept fully aware of the EPB programme.

APPENDIX I

BUDGET PROPOSAL 1981 "GEOTHERMAL HEAT STUDIES" \$750,000

The use of geothermal heat has been successfully demonstrated in several parts of the world. It is only recently being considered as an efficient energy source in Canada. Granted, Eastern Canada is lacking in very high temperature surface heat sources (hot springs, active volcanic centres), indications are that there is potential from deep Dry Hot Rock sources and Deep Sedimentary Basins. Public Works Canada, through its Energy Secretariat has initiated the ATES Demonstration Program in 1980 (Aquifer Thermal Energy Storage). Research in the ATES program will provide the technology for the utilization of low heat flows.

Geothermal Heat studies in the U.S. and Europe have also demonstrated that heat flow measurements in and along the contacts of intrusive rocks provide a means of delineating favorable zones of mineralization. Already, we note that the Brunswick and Heathcote Steel deposits are associated with very high radiogenic heat patterns determined from airborne radiometric data.

The overall objective of the study therefore, would be to acquire geothermal data to ascertain areas of potential geothermal energy sources and also for the purpose of delineating potential zones of mineralization.

The first phase of the project will involve the compilation of data, interpretation of Radiometric and Landsat data, gravitational and magnetic potentials and their relationships to thermal potential. This phase of the project will take one year.

The second phase of the project will involve field mapping and measurements of heat flow both below the surface and at the surface-air interface. The results of these field investigations will be used to provide Quantitative Radiance Maps.

The third and final phase of the project will involve the drilling of deep wells within the potential zones indicated by geothermal heat flow measurements. These holes will be cored and geophysically logged.

At this time, recommendations will be made as to the feasibility of the development of geothermal power.

DEPARTMENT OF NATURAL RESOURCES
BUDGET SUBMISSION

I PROJECT TITLE: Geothermal Heat Studies

II PROJECT NUMBER:

III TYPE OF PROJECT:

IV TOTAL ESTIMATED COST: \$750,000

V COST BY YEAR:

Year 1	100,000
2	100,000
3	100,000
4	100,000
5	350,000

VI COMPLETION DATE: Year 5

VII INITIATED FROM: Fredericton Office

VIII PRESENT SITUATION:

1. Preliminary Radiogenic Heat Product Map @ 1:500,000
2. Compilation of whatever data is available will be done by fall of 1981.
3. Airborne Radiometric data (regional).
4. Gravity maps.
5. Magnetic maps.

In 1980, EMR initiated a Geothermal Heat project in Eastern Canada. The sequence of work in the region is as follows:

Phase 1 - Compile existing data

Phase 2 - Acquire data on an opportunity basis

Phase 3 - Generate data

Though Phase 1 is completed in P.E.I. and Nova Scotia, New Brunswick is still to start. Phase 1 in New Brunswick will hopefully commence in the fall of 1981.

In September 1980, five holes drilled into Carboniferous sediments were logged by A.M. Jessop and M. Drury (E.M.R.). However, a geothermal gradient was only

definable in two holes at Fredericton and Tracy respectively. The gradient was measured at 26.5 mkm^{-1} with a surface temperature intercept of approximately 6°C . The regional gradient needs to be defined more clearly and more importantly, any areas of anomalously high thermal gradient must be located.

IX PROPOSED ACTION:

Data needed

Sedimentary basins

temperatures
permeabilities
porosities
thickness of aquifers
water chemistry
geopressures
water flow patterns

Intrusives

masses
depths to tops etc.
temperatures
radiogenic heat (K,U,Th)
heat flows

1. Re-evaluation of Radiometric data (\$50,000 year 1).

Working from original aero-radiometric magnetic tapes, more accurate radiogenic heat maps will be produced. The result will be 5 maps at the 1:500,000 scale.

1. Radiogenic Heat Map from K
2. Radiogenic Heat Map from U
3. Radiogenic Heat Map from Th
4. Radiogenic Heat Map from (K + U + Th)
5. Radiogenic Heat Map from the combined ground equivalents of K + U + Th

2. Compilation of Remote Sensing Data (\$20,000).

Purchasing of ERTS photographs and the preparation of mosaics. Each channel of data will be evaluated in conjunction with magnetic gravity and radiometric data. The cost of color reproduction will limit regional maps to a scale of 1:500,000. 1:250,000 scale maps will also be available.

3. Purchasing of geothermal logging equipment, seismograph and gamma-ray spectrometers (\$60,000).

4. Logging of drill-holes on an opportunity basis (\$20,000/yr. 5 years).

The exploration and mining industry will be encouraged to log drill-holes or to allow government access to log using geothermal and gamma-ray sensors.

5. Basin analysis (Carboniferous - Main Plaster Rock & Moncton Sub-basins) (\$100,000).

This part of the project will be done with the cooperation of the Water Resources Branch of the Department of the Environment.

Data needed

Water flow patterns

geopressures

temperatures

permeability

porosity

thickness of aquifers

modelling of liquid geothermal systems (using above data)

6. Detailed γ -ray mapping of the granites (\$100,000) (particularly the Pokiok & Charlotte Batholiths).

Creating detailed radiogenic heat maps based on closely spaced ground data collected by hand-held sensors.

7. Chemical analyses (\$10,000).

Trace element analyses of rock samples collected

Whole rock analyses

γ -ray Laboratory analyses

U - analyses by Neutron Activation

8. Drilling and geophysical logging of 2 deep drill-holes \$310,000 (Year 5).

Year: 1 (1982)

PROGRAM & LOCATION: Geothermal Heat Studies (New Brunswick)

OFFICER-IN-CHARGE: J.J. Chandra

TOTAL BUDGET (All Primaries) \$ 99,910

SALARIES \$ 53,280

Classification	Approx. Rate	Total
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Geologist (12 mths.)	1700/mth.	20,400
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Engineer (12 mths.)	1700/mth.	20,400
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2 Field Assistants (4 mths.)	750/mth.	6,000
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Clerk-Typist (6 mths.)	1000/mth.	6,000
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4% vacation pay		480
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CIVIL SERVICE PAYROLL-REGULAR \$

OVERTIME \$

RETIRING ALLOWANCE \$

CASUAL PAYROLL - REGULAR \$

BLUE CROSS (EMPLOYER'S SHARE) \$

U.I.C. (EMPLOYER'S SHARE) \$

MEMBERSHIP DUES & FEES \$

TUITION & EXAMINATION FEES \$

TOTAL PRIMARY 3 \$ 53,280

ADVERTISING (NEWSPAPERS, RADIO, TV, ETC.) \$

FEES & COMMISSIONS (EXAMINERS, JURORS, ETC.) \$

FREIGHT, EXPRESS & CARTAGE \$ 500

DUTY & BROKERAGE \$

HAULAGE \$

HEAT \$

LIGHT AND POWER \$

WATER \$

INSURANCE & BONDING \$ 500

361	LAUNDRY SERVICES	\$	
491	CATERING SERVICES	\$	
501	ENTERTAINMENT	\$	
511	CLEANING SERVICES	\$	
520	POLICE & SECURITY SERVICES	\$	
530	INSPECTION SERVICES (OFFICE EQUIP. ELEVATORS)	\$	
611	POSTAGE	\$	200
631	DATA PROCESSING SERVICES	\$	9,000
650	PROFESSIONAL SERVICES, (ANALYSTS, ETC.)	\$	2,000
701	PRINTING	\$	300
702	COPYING	\$	500
711	SNOWPLOUGHING	\$	
720	RENTALS (LAND & BLDGS, CARS, TRUCKS, HEAVY EQUIP., ETC.)	\$	8,000
760	REPAIR SERVICES (VEHICLES, MACHINERY, BLDG., OFFICE EQUIP.)	\$	1,000
4861	MONTHLY CHARGES - TELEPHONES CRT Terminal	\$	2,000
4862	LONG DISTANCE CHARGES - TELEPHONES	\$	300
4901	BOARD & LODGING - IN PROVINCE	\$	10,000
4902	MILEAGE - IN PROVINCE	\$	500
4903	AIRFARES - IN PROVINCE	\$	
4905	BOARD & LODGING - OUT OF PROVINCE	\$	300
4906	AIRFARES - OUT OF PROVINCE	\$	300
4907	OTHER OUT OF PROVINCE TRAVEL COSTS	\$	500
4911	REGISTRATION FEES	\$	200

TOTAL PRIMARY 4\$ 36,100

5040	AGRIC, HORTIC & ANIMAL SUPPLIES	\$	
5091	BOOKS, NEWSPAPERS & MAGAZINE SUBSCRIPTIONS	\$	200
5121	CLOTHING	\$	
5180	EDUCATIONAL & TEACHING MATERIALS	\$	
5241	FOOD	\$	
5331	HEATING FUEL	\$	
5410	HOUSEHOLD & CLEANING SUPPLIES	\$	200
5531	TIRES	\$	
5532	GAS, OIL & GREASE	\$	4,000
5539	OTHER (VEHICLE PARTS)	\$	
5580	MEDICAL, SURGICAL & LABORATORY SUPPLIES	\$	3,000
5630	OTHER SUPPLIES (SMALL TOOLS, DRAFTING, PHOTOGRAPHIC, ETC.)	\$	500
5731	PAPER, PENCILS, LETTERHEAD, ETC.	\$	100
5732	FORMS	\$	50
5810	STRUCTURAL MATERIALS & SUPPLIES (LUMBER, ELEC, PAINT, PIPE, SAND & GRAVEL)	\$	300
	TOTAL PRIMARY 5.....	\$	8,350
6020	BUILDINGS	\$	
6040	MACHINERY & VEHICLES	\$	
6060	OFFICE FURNITURE & EQUIPMENT (DESKS, FILING CABINETS, PRINTERS, TYPEWRITERS, ETC)	\$	
6070	DATA PROCESSING EQUIPMENT	\$	2,000
	TOTAL PRIMARY 6	\$	2,000