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May 13/85

ASSESSMENT OF THE GEOTHERMAL POTENTIAL OF ATLANTIC CANADA

1984-1985 PROGRESS REPORT

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The programme for the assessment of the the geothermal energy potential of Atlantic Canada was operated on a reduced scale in 1984-85, as it is now substantially complete in its present form and scale. With the possible exception of south-west Newfoundland, the areas worthy of further investigation have been identified, and further progress will depend on more localised investigatuons on an enhanced scale of expenditure. The general geological situation will be summarised at the end of this report. Four contracts were awarded; one for a continuation of the data collection, one for management of drilling, and two for drilling. Of the latter, one was only partly funded, approximately 37%, from the geothermal programme. In addition, three in-house field surveys were undertaken, in Prince Edward Island and New Brunswick.

1. Drilling on Prince Edward Island

Following the previous drilling programme on P.E.I., at Charlottetown in 1983, it was decided that an apparent anomaly in thermal gradient in the western part of the Island should be investigated. Over most of the Island the geothermal gradient is in the range 14-17 mK/m, but at one location, near MacDougall, bottom hole temperature data from a single hydrocarbon exploration well indicated a gradient of 26-27 mK/m. As such data are often unreliable it was decided to sink a shallow well near the location of the original well in order to get an accurate measurement of temperature gradient (see Fig. 1 for location).

The well was drilled by Longyear Canada Inc. It was spudded on 09.10.84 and completed on 24.10.84. The planned depth was 500 m. There were some difficulties with caving, and the drilling was ended at a depth of 460 m. A series of temperature logs was begun immediately; the data were presented in

the report by John A. Leslie and Assocs. Ltd. (JALA), who managed the drilling operation under contract. The gradient indicated from a log four months after the end of drilling is 14 mK/m, similar to the gradient measured on other parts of the Island. Although this result does not disprove the existence of a higher gradient at a greater depth, and therefore of a potential geothermal resource, it casts doubt on the validity of the bottom hole temperature. Given a thermal conductivity that does not vary significantly with depth, an increase in thermal gradient could be observed if there is a net downward movement of ground-water, a phenomenon that has been suggested to explain the vertical pattern of thermal gradients in the Western Canadian Sedimentary Basin. Not enough is known about the hydrological nature of the Magdalen Basin to assess whether there could be a similar phenomenon at depth below P.E.I. Such knowledge might be obtained from a programme of deep drilling on the Island, but such a programme is now far beyond the means of the geothermal energy budget. It is to be hoped that there will continue to be sufficient funding of the geothermal programme so that temperature and hydrological data can be obtained should industrial holes be drilled.

2. Drilling in Nova Scotia

Measurement of heat generation of surface samples collected from the Wedgeport granite of south-western Nova Scotia suggested that the amount of heat being produced from radoiactive decay in the small pluton may be approximately three times that of the larger South Mountain batholith. The phenomenon of batholiths that are abnormally radiogenic is of considerable scientific interest, and it is also relevant to the assessment of hot, dry rock geothermal resources. Consequently a hole was drilled to a depth of 483 m in the pluton in January 1985, by Logan Drilling Ltd. (see Fig. 1 for

location). Management of the drilling was again conducted by JALA as part of their contract for the collection of data. The drilling and logging project was funded jointly by E.P.B. A-base (63%) and the geothermal programme, because of the interest of both. The hole was the first drilled since 1969 by the geothermics group for purposes other than in support of applied programmes. The thermal gradient is approximately 20 mK/m, which suggests a normal value of heat flow. It appears that the radiogenic layer is thin, approximately 1-2 km, but complete analysis must await the measurement of thermal conductivity and heat generation of core from the hole. There is obviously no potential for hot, dry rock geothermal energy.

The author is a co-investigator in a deep drilling programme being conducted by the Nova Scotia Department of Mines and Energy. The first of four planned 1700 m holes is currently being drilled in the South Mountain batholith. Thermal investigation of those holes will add considerably to the assessment of the geothermal potential of the region.

3. Data collection

A small contract was let to JALA to continue the collection of data from holes of opportunity. Much of the activity for the contract was related to the Nova Scotia drilling, but some temperature data from other new holes were obtained, including a further log of the Charlottetown hole. None of the new data indicated any areas for further study.

4. In-house geophysical surveys

Three geophysical surveys were undertaken by E.P.B. personnel, funded from the geothermal programme. A gravity survey across the St. George Batholith in southern New Brunswick was performed by M. D. Thomas. The

purpose was to obtain an estimate of the thickness of the batholith. A hole drilled in 1982 had resulted in heat flow data that showed that what had been thought might be a potential hot, dry rock resource was not so; a highly radiogenic layer at the surface must be no more than 1-2 km thick.

A further magneto-telluric (M.T.) survey in western P.E.I. was organised by A. Jomes, the purpose being to study an area over a positive gravity anomaly in more detail than was done in an earlier survey. Jones also led a team that carried out an M.T. survey in the Fredericton Trough, in order to better define the depth and structure of the sediments.

At the time of writing no final results are available from any of the field surveys. All produced good data that are currently being reduced ready for analysis; it is expected that final reports will be ready by the end of the summer.

Summary of current situation

The prospects for large-scale utilisation of geothermal enrgy in Atlantic Canada are low, partly because of the generally unfavourable geological nature of the region, and partly because there are no major centres of population in those areas in which there is some indication of reasonable geothermal potential. The Stellarton - New Glasgow area of Nova Scotia and the Fredericton Trough area of southern New Brunswick are the only areas where temperature data have indicated the possibility of a low-enthalpy geothermal resource. Although hydrological studies have been undertaken in both areas, the results were inconclusive. There have been serious expressions of interest from potential users or developers; aquaculture in New Brunswick and agricultural processing in Nova Scotia, for example. The need now is for detailed studies in those areas of interest,

including deep drilling, which is not possible with the current geothermal budget. There are presently insufficient temperature data from the Deer Lake and Codroy Basins of Newfoundland to warrant a hydrological study of those areas, but should further data become available, such a study may be required in the future.

Figure 1. Location map to show sites of 1984-85 drilling programmes, indicated by diamonds. Numbers indicate thermal gradient, where this is above 25 mK/m, estimated values being in parenthesis.