HYDROGEOPHYSICAL REPORT 80/6

ORIENTATION SOUNDINGS - CANNON HILL AREA

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1. INTRODUCTION

During late 1979 a series of vertical electric soundings were completed in the Cannon Hill area by staff of the Hydrogeology Section, Water Division, N.T. Department of Transport and Works.

This work was completed on the 15th and 18th of December and comprised 8 Schlumberger soundings (involving approximately 400 observations of apparent resistivity).

The soundings were completed as a normal orientation exercise prior to the design and execution of a routine resistivity profiling survey in the area.

Work was confined to 10 nominated and surveyed traverse lines distributed over an area of some 100 square km, located in the vicinity of the East Alligator River both south and west of Cannon Hill.
2. GEOLOGY OF THE AREA

The bedrock geology of the area comprises Lower Proterozoic sediments and metamorphics. These lithologies are for the most part obscured by a surficial cover of Tertiary to Quarternary sands and laterites.
3. SURVEY OBJECTIVES

The objective of the present work was to investigate the prevailing geoelectric conditions as a prerequisite for the proper design and execution of resistivity profiling operations in the area. The aim of this subsequent work is to monitor bedrock resistivities in order to detect intrabedrock zones of anomalously high permeability.
4. INSTRUMENTATION

The resistivity unit employed on the survey comprised a high voltage, moderately powered system capable of resistivity observations at in excess of (Schlumberger) array separations of 1000 metres. This instrumentation is described in detail elsewhere (Hydrogeophysical Report 80/2).
5. FIELD TECHNIQUE

Schlumberger soundings involved the expansion of half current electrode separations (AB/2) of from 2.5 to 500 metres. Half potential separations (MN/2) of 0.5, 2.5 and 10 metres were employed in three overlapping sounding segments.

Due to a very hard and dry surface cover over much of the area it was found necessary to wet the driven stake current electrodes with salt water in order to lessen the contact resistances.
6. RESULTS

Illustrated in plates 1 to 7 are the results of a quantitative analysis of suitable sounding curves. Included in these illustrations are:

(1) field curves arrived at by appropriate segment migration, smoothing etc (dashed curves),

(2) strip representations of the solution earth model, and

(3) computed sounding curves relevant to the solution earth models (shown as discrete points).

It must be noted that these solutions are simply the result of a best fit criterion and as such represent a convenient (although not necessarily physically exact) presentation of the interpretations. These solutions must be constrained by drill-hole or other information in order to resolve the ambiguities of equivalence and suppression.

The above considerations however do not effect the objectives of the present survey. With respect to these the interpretations indicate:

(1) The prevailing geoelectric section in the area is of the H and QH type, and as a result sounding interpretation (in the absence of drill-hole information) is susceptible to equivalence and suppression.

(2) Bedrock resistivities are generally very high with respect to the second layer resistivities (i.e. greater than 40 times).

(3) Electrode separations in excess of 100 metres are required to sense bedrock resistivity variations.

(4) Soundings are marked by a large variation in total longitudinal conductance (S) associated with the units lying above the resistive bedrock.
7. CONCLUSIONS

The following conclusions are relevant to the projected profiling operations:

(1) The profiling array should have a depth of investigation considerably in excess of that of a Schlumberger configuration with an AB/2 of 100 metres.

(2) Profiling results at large separations in the area can be expected to show considerable variations due to changes in the total S (associated with the suprabasement layers).

As a result of these observations it is suggested that:

(1) A pole dipole array be employed on the production survey with the following parameters:
   (a) a potential dipole length (X) of 50 metres,
   (b) a current pole, potential dipole separation (nX) of 250 metres, and
   (c) a station spacing of 20 metres.

(2) All significant conductive anomalies found on the profiling operations should be tested by Schlumberger soundings to determine their origin. Such an operation will show if conductive indications are the result of an increase in longitudinal conductance or due to low basement resistivities.

These follow-up soundings should be expanded up to half current separations of 200 metres.