DEER LAKE SEISMIC SURVEY - OPERATIONS AND INTERPRETATION REPORT

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Processing and Interpretation of Seismic Data, Reidville, Newfoundland

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Introduction: From 20 - 22 June 1994, the Centre for Earth Resources Research (CERR), Department of Earth Sciences of Memorial University of Newfoundland collected reflection seismic data along a short line near Reidville in the Deer Lake Basin Newfoundland. The objectives of this test were to determine optimal shooting parameters for seismics in this region and to conduct a short line data collection for evaluation.

Geological Environment: The general geological setting is within the Carboniferous Deer Lake basin in western Newfoundland. The line is entirely within the outcrop of the Humber Falls formation and is underlain, at depths of about 200 m by the Rocky Brook formation. Both these formations are dominantly lacustrine, clastic sequences with poorly defined seismic signature.

Acquisition: The data were acquired with a 96 channel OYO DAS-1 high resolution seismograph with 250 gm boosters as the sources. Shots were at depths of 1.5 to 2.5 m. The seismic profile was established as an approximately 1800 m long line roughly along the strike of the small synforrn mapped by Hyde. It was decided from a wave test that a station spacing of 10 m would provide adequate coverage. Shot points were established at the mid-point of every second station for a nominal 24 fold recording. Receivers were 14 Hz single geophones placed at each station. A 3 s record with 0.5 ms sample rate was collected.

Processing: The field data were transferred from the optical disc used in field recording to our SUN SPARC computer for all processing. The package used is the IT&A/INSIGHT seismic processing package, commercial software for processing seismic data in petroleum exploration. This package has a good selection of routines adaptable for processing these data. The flow of processing is given in Table 1.

Interpretation: Several sections were produced, but the two in this report are the flnal 'standard' processed sections at a horizontally expanded scale and one at roughly 1: I for a velocity of 4000 m/s.

The base of Humber Falls Is seen within the top 100 ms as expected. Below this there are several high frequency sub-horizontal reflectors that are inferred stratigraphy within the Rocky Brook. The deepest of these is at about 900 ms TWT (an approximate depth of 1800 m). The records from 1 s to 3 s show no clear reflectors.

TABLE 1. PROCESSING SEQUENCE

1) Geometry Definition
The survey data describing the geographic locations and elevations of stations was combined with information provided in the observer's logs which describe the positioning of sources and receivers relative to stations. This allows the precise determination of source, receiver and midpoint coordinates for each trace recorded in the field.

2) Common Midpoint Binning
A processing line was chosen which passed through the scatter of midpoints described by the crooked aquisition line. Bins with in-line heights of 5 metres and cross-line widths of 60 metres encompassed 84.5% of data. The maximum fold obtained was 49 with a nominal fold of 24.

3) Bulk Shift
The seismic caps used to detonate the main charges has a 25 millisecond delay associated with them. All of the data was bulk shifted by this amount to account for this delay.

4) Trace Editing
Excessively noisy traces were removed from the processing stream.

5) Refraction Statics
The first break times were picked for all shots and this information was then input into the Hampson-Russell GU3D refraction analysis package. The use of this package allowed the creation of an accurate near-surface model. From this model, a set of static corrections was generated which, when applied to the seismic data, corrects for the distortions produced by near-surface anomalies.

6) Gather
Resort the data from the common shot domain to the common midpoint domain.

7) Apply Refraction Statics
The static corrections calculated from the refraction analysis were applied.

8) Spectral Balance
The CMP gathers were spectrally balanced between 25 and 100 Hz over 25 Hz bands with 10 Hz tapers using a 200 millisecond AGC. A 25 to 100 Hz window was chosen from the examination of filter panels of shot records selected at regular intervals along the acquisition line.

9) Normal Moveout Correction
The velocity functions employed were taken directly from the near-surface model derived from the refraction analysis. Velocity functions were defined at every 20 stations (200 metres) along the acquisition line. Automatic stretch muting of the NMO corrected gathers was employed with a 500% stretch tolerance.

10) Apply Residual Statics
CMP gathers with refraction statics applied, spectrally balanced with parameters as specified in step 7, nmo corrected as per step 8 and bandpass filtered between 25 and 100 Hz were analyzed to calculate surface-consistent residual statics. The algorithm used permits the stacking of pilot traces and is designed

to be used on low-fold/low signal-to-noise data sets. It uses a slant stack approach with semblance weighting to create a pilot trace. The static corrections calculated from this algorithm were then applied.

11) Stack
Standard mean amplitude stack of CMP gathers.

12) Bandpass Filter
Stacked data were bandpass filtered between 25 and 100 Hz using 10 Hz tapers.

13) Automatic Gain Control (AGC)
A 200 millisecond window AGC was applied for display purposes.