Seismic and Magnetotelluric Fieldwork in the Howley Basin

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September 2013 Seismic Program – Eastern Howley Basin

Diagram showing the location of the Cabot Fault System and the Eastern Bounding Fault in the Eastern Howley Basin. The diagram includes various geological features such as lakes, rivers, and seismic lines labeled HB13-01 and HB13-02.
Survey Stats

Recording Data
- MUN Aries Lite recording system
- 180 live channels
- 10 m group spacing
- 5 m notional CMP spacing
- 45 Fold
- Maximum offset – 1820 m
- Profile length – 7 km

Source Data
- shot spacing – 20 m
- 4 sweeps/shot point
- sweep length – 15 s
- listen time – 5 s
- 420 shot points including shoot throughs at both ends

Personnel/training
- C. Hurich and 5 graduate students
Objectives/Preliminary Results of the Sept. 2013 Seismic Program

- Acquisition of seismic data along the T’Railway not approved for exploration license so the acquisition was limited to road on crown land east of Howley

- Acquire data across the eastern bounding fault of the basin

- Test the level of source energy required for data acquisition
  
  2013 data acquired using the MUNSIST seismic source

- Data processing is ongoing

- Based on field records
  
  - Clear evidence of reflections in the first 1-1.5 km of the data
  
  - Likely unconformity at ~ 500-600 m
MUNSIST

Swept impact seismic source designed for environmentally friendly, high resolution imaging

MUN designed custom control software linked with a commercial hydraulic rock breaker

Successfully deployed for surveys in western Newfoundland (5 Mile Road and Flat Bay) and 2 surveys at Voisey’s Bay
Data Acquisition

Brandon Reid - MUN MSc student – acquisition computer

Aries RAM and battery - each RAM handles 8 channels A/D

Geophone placement
MUN Occupation of the Howley Tourist Lodge
The Magnetotelluric Method

www.nasaimages.org
The Magnetotelluric Method

St John's based on 1-minute preliminary data February 14, 2008

- $B_x$ (nT)
- $B_y$ (nT)
- $B_z$ (nT)
- $B_f$ (nT)

Time, UT

Canada

Natural Resources
Ressources naturelles
Canada
Measure $E$ and $H$. Their ratio contains information about the electrical conductivity of the subsurface.
Magnetotelluric Method

- **Source:** the flow of charged particles in the ionosphere, such as lighting and solar energy, causing natural variation in the magnetic field under the Earth’s surface, that induce electric currents.

- **Results:** imagines the earth’s electrical resistivity structure from depths of a few 100 meters to several 100’s kilometers.
August/September 2013 MT Program – Howley Basin

AMT Sites (39 in total)
BBMT + AMT Sites (10 in total)
Remote Site
Survey Stats

Recording Data
- Four Phoenix MT Units
- 12 AMT Coils, 6 BBMT Coils
- Two types of electrodes: pots and rods
- AMT spacing: 500 m
- AMT recording time: 2-4 h
- BBMT spacing: 2 km
- BBMT recording time: overnight
- Profile length – ~18km

Personnel/training
- Jessica Spratt and 3 graduate students
Data Acquisition and Field Work

Jessica Sprat connecting and turning on the MTU

Placing a coil underground

Equipment layout
• **TM mode**
  - Electric field polarized across electric strike.
  - When $H_x$, $E_y$ and $E_z$ are comprise.
  - Affected mainly by galvanic effects.

• **TE mode**
  - Electric field polarized along (parallel) electric strike.
  - When $E_x$, $H_y$ and $H_z$ are comprise
  - Affected by galvanic and inductive effects.

An image of MT data from MTEditor after data has been cleaned from the noise
Phase Pseudosection

Pseudosections of the phases with increasing period of TE and TM modes. Data is 1D where the difference between phases is less than 10°.
1D Example

Pre-editing

Post-editing
An image of MT data from WinGLink of Station HW136, with fitted resistivity model
Resistivity Profile from 1D TE and TM modes