

Geophysical Methods For Characterization Of Permafrost Monitoring Sites

Members of the Terrain Geophysics Section Geological Survey of Canada

- Geophysical surface methods can be used to establish the third dimension during initial reconnaissance surveys of potential monitoring sites.
- Selected surface and borehole geophysical methods can be used for time-variant measurements of physical properties at established permafrost monitoring sites.

Surface Geophysical Methods

- Electrical / electromagnetic
- Seismo-acoustic
- Ground penetrating radar

Borehole Geophysical Methods

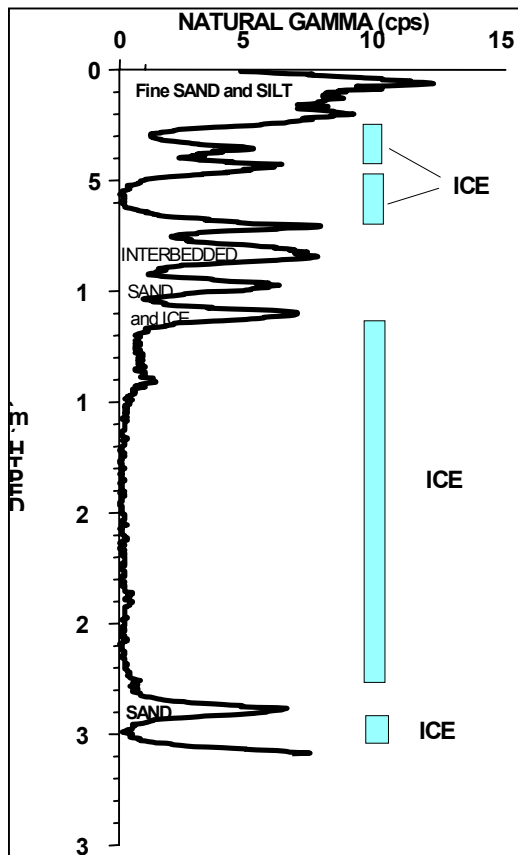
- Electromagnetic
- Natural gamma
- Magnetic susceptibility
- Gamma-gamma density
- Temperature (gradient)
- Spectral density ratio (average z #)
- Downhole compressional velocity
- Downhole shear velocity

Methods To Determine Ice Content

- Electrical / EM
- P&S velocities
- Radar
- Natural gamma
- Density
- Spectral ratio

Example 1: Detection of Massive Ice Lenses using a Borehole Gamma Sonde

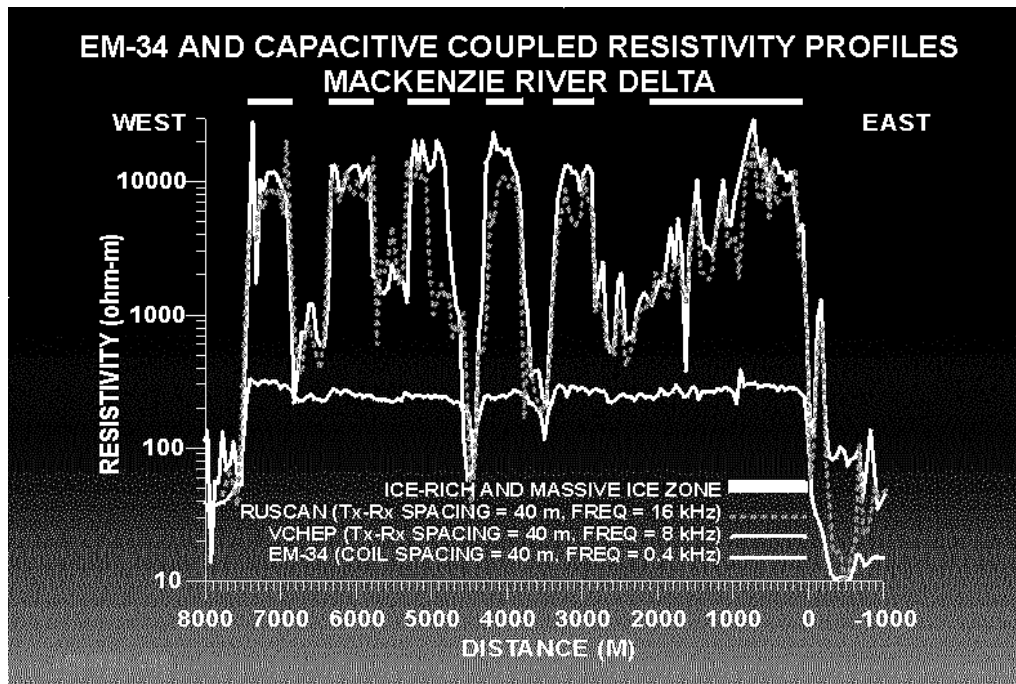
- -count-rates below 20 cps indicate segregated ice lenses
- -count-rates between 40-60 cps indicate fine sand
- -count-rates between 60-120 cps are indicative of silt



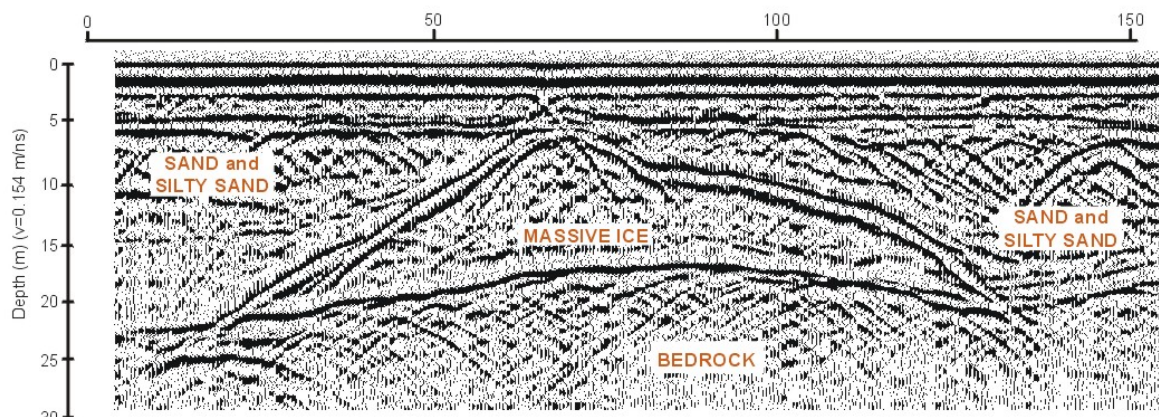
Methods To Determine Soil Type

- Natural gamma
- Magnetic Susceptibility
- Conductivity
- Spectral ratio

Example 2: Surface Electrical Mapping



Example 3 :Ground Penetrating Radar (GPR) to detect buried massive ice



Example 4:

Detection of non ice-bearing material using a borehole EM sonde

