
**Investigating the extent and structure of the
Cretaceous Basin at Vinegar Hill, NB, using
seismic reflection and seismoelectric surveys**

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The Vinegar Hill silica sand deposit, located near Cassidy Lake south of Sussex, NB, is of interest both as an economic resource and for its not recently confirmed status as a part of New Brunswick's only known basin of Cretaceous age. The unconsolidated sand and clay sediments within the basin overlie Carboniferous-aged red beds of the Mabou Group and are covered by glacial till. In July, 2004, geophysical data were acquired to investigate aspects of the basin's shape, depth extent and internal structure which could not be inferred from the sparse borehole control.

Surface geophysical surveys were conducted using shallow P-wave seismic reflection and experimental seismoelectric methods. Seismic data were acquired using a 48 channel asymmetric split spread with 50 Hz geophones at 3 m intervals. A 12-gauge in-hole shotgun source was used in shallow holes every 6 m along the line.

The first seismoelectric survey was acquired concurrently with the seismic data, using the same source but a separate 36 channel recording system connected to electric field antennas rather than geophones. A second set of seismoelectric records were acquired in November, 2004 using a stronger, explosive seismic source (trade name Geogel). This follow up investigation was conducted in select areas where strong reflectors had been identified in the seismic data.

A total of 1.7 km was surveyed along two seismic lines – a 1 km line running N-S across the basin, and a 0.7 km line oriented sub-parallel to the basin axis. The quality of the seismic data varied with location, apparently in response to the variations in the depth of the water table or in the properties of the surficial sediments. In some areas we obtained excellent high frequency records exhibiting reflectors to two-way travel times of 150 ms. These two-way times translate in roughly 135–150 m depth assuming an average P-wave velocity of 1800–2000 m/s for the unconsolidated basin fill. These results agree with the estimated depth to Carboniferous bedrock obtained from the drill cuttings log for a nearby borehole (IMC-15) drilled during the 1970's for potash exploration. The seismic data also indicate that the basin has an asymmetrical bowl shape truncated to the north by the Clover Hill fault. Layers on the south side of the basin dipped significantly towards the north and there is evidence of syn to post-depositional folding and faulting within the basin itself.