

Airborne Electromagnetic Evaluation of Buried Quaternary Gravels in Northeast British Columbia

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ABSTRACT

Mapping of buried Quaternary channels in northeast British Columbia has recently become of interest because of their shallow gas potential and the critical need to find gravel deposits for petroleum road construction. In the former case, thick sequences of low permeability sediments capping the paleochannel deposits are necessary to seal the reservoir. In the latter case, gravels close to surface with minimal overburden are preferred. Such deposits, however, are relatively rare in NE BC. Techniques commonly used for identifying gravel deposits, such as geomorphological mapping, are ineffective for locating these blind channels. Additionally, ground based exploration techniques are too costly and time consuming for covering vast areas of investigation such as the plains region of NE BC. In this paper we report on the results of an high resolution airborne electromagnetic (EM) survey of a buried gravel deposit in the Kotcho area of NE BC (NTS map area 93I/15).

The survey was centered on a deposit originally discovered during a follow-up field investigation of reported buried gravels encountered in seismic shot holes. Excavations in the vicinity of the reported occurrence show gravels underlying silt rich sediments. The buried sands and gravels were encountered in 10 test pits in an elongated, southwest-trending area, oblique to present surface stream channels. The sands and gravels occur along a gentle southeasterly slope with no obvious geomorphic indications of their presence. They are overlain by silts and clays generally 1-2 m, but locally up to 5 m, thick. These sediments are interpreted to be glaciolacustrine in origin. In the inferred core of the paleochannel, the sands and gravels are at least 5 m thick and in six of the test holes the base of the channel was not encountered. Surprisingly, the water table was encountered in only one test hole at the southeastern most edge of the deposit.

The airborne EM survey was conducted over this area to evaluate the utility of the method for mapping shallow gravel deposits, to attempt to trace the extent of

the Kotcho gravel deposit beyond the field tested boundaries and to identify any new gravel targets in the region. To accomplish these goals a detailed survey with 100 m line spacing was flown over the Kotcho deposit and 200 m line spacing was flown over a larger area (~25 km²) around the known deposit. The survey employed the helicopter RESOLVE multi-coil multi-frequency EM system supplemented by two high sensitivity cesium magnetometers and a GPS electronic navigation system. The EM system was located in a bird flown at an average height of 39 m above the ground. Apparent resistivity maps were produced from the 400, 1500, 6400, 25,000, and 115,000 Hz data. On the high frequency data reflecting the shallow geology, three main areas of high resistivity were identified in the survey. The northernmost area coincided remarkably well with the area of shallow buried gravels as mapped out by the field investigations. The southern two areas are much larger and will be the focus of future ground investigations. The results strongly indicate that high resolution EM surveys can be an effective tool for mapping buried sand and gravel deposits.