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Data Serendipity While Mapping Quaternary Channels in the MacKay River Area

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Summary

A case study in the MacKay River area illustrates the integration of corehole, 2D seismic and airborne EM data to map Quaternary channels. The channels may be revealed on any one type of data, but all 3 techniques contribute to a most complete understanding.

Introduction

Geological and geophysical data acquired for other purposes provides insight into the presence of Quaternary channels and valleys in the MacKay River area. These channels are important for a variety of reasons: they are a local source of water, contain aggregate minerals and may have a harmful effect on seismic imaging. They may affect the production process by acting as a heat sink to injection wells. These features are known to incise deeply enough in some areas that they remove McMurray resource (Andriashek, 2007) and can have a profound effect on caprock integrity, although this is not the case in the MacKay River Project Area.

Method

Well logs are acquired to evaluate the oilsands reservoir and caprock interval. Typically, surface casing is set about 5 metres below the base of the Quaternary section and a γ-ray log is run through the surface casing section. This is sufficient to identify the presence of channel sediments and is the basis for geological mapping efforts. Integration of cuttings analysis and penetration rate supports the well log interpretations.

Seismic reflection surveys reveal the presence of Quaternary channels both directly through channel morphology images on the data, and indirectly where channel sediments are more attenuative to the seismic signal than surrounding material.

Airborne electromagnetic surveying provides data that investigates the electrical conductivity of the shallow earth. Slightly more than 3800 line-kilometres of aeroEM data were acquired at MacKay River during 2008 in concert with high-resolution aeromagnetic data to investigate regional structural trends. Where there is a significant resistivity contrast between Quaternary channel fill and surrounding tills, the channels are evident on inverted aeroEM data.

There are locations where Quaternary channels are evident as an acoustic feature, but not an electrical feature and other locations where resistivity is more diagnostic. Seismic data is sparsely available compared to the airborne EM data. Where well logs are abundant, geological mapping provides the greatest detail about these features. It is the integration of these techniques that yields the most complete picture.

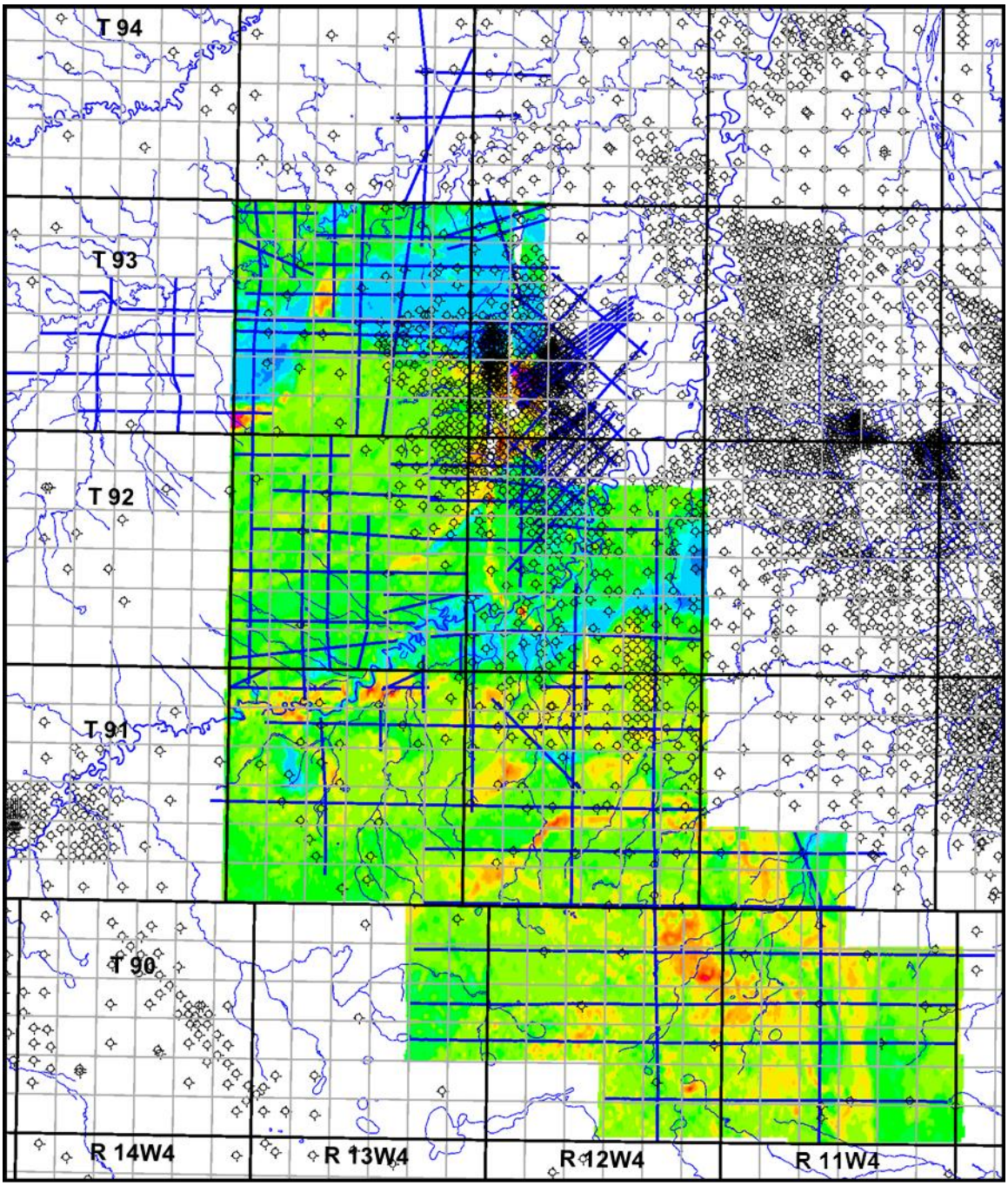

Figure 1: Corehole locations, 2D seismic database and RESOLVE aeroEM 5 metre resistivity depth slice. The single resistivity map slice alone is not diagnostic of surface material.

Conclusions

Integration of multiple techniques, with contributions from different geoscience disciplines has provided a more complete understanding of the shallow-earth section. The resulting mapping will allow us to better focus our efforts to evaluate groundwater potential and aggregate resources throughout the MacKay River property and to assess the potential impact of Quaternary channels on bitumen resource.

Much of the data used in this study was acquired for purposes beyond those of the present analysis and bent to the needs of this investigation. It is well worth searching through archival data to extract

increased value from sources that, having served their purpose for prior investigations, may be waiting patiently to be put to exciting new uses.

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References

Andriashek, L. D., Atkinson, N., 2007, Buried Channels and Glacial-Drift Aquifers in the Fort McMurray Region, Northeast Alberta: EUB/AGS Earth Sciences Report 2007-01, 169 p.