Mapping Buried Paleo-valleys with Integrated Visualization of Airborne Geophysical Data

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Summary

Examples and contour maps of paleo-valleys illustrates how this suite of geophysical techniques increases the precision of geological mapping and makes it more advantageous to analyse paleo-valleys for groundwater exploration.

Introduction

Ancient rivers called buried paleo-valleys are an important source of groundwater and it is well documented that paleo-valleys in Western Canadian Sedimentary Basin (WCSB) have higher magnetic and resistivity properties compared to the surrounding sedimentary media. Geophysical methods have been used for imaging buried paleo-valleys.

Theory/Method

A numerical solution for potential field phases using directional derivatives of the aeromagnetic data in three dimensions enabled precise mapping of the angular changes of the geological features associated with buried paleo-valleys.

Further mathematical and imaging processing delineated the precise edges and banks of the paleo-valleys. Detailed flight line attribute analysis discriminated between stacked pre- and post glacial paleo-valleys based on their resistivity and magnetic signatures. This procedure was also effective in imaging confluents of paleo-valleys and their intersections with faults.

Conclusions

This study shows that even the buried paleo-valleys with faint geophysical signature can be located with integrated high resolution imaging of airborne electromagnetic and magnetic data in Southern Alberta.

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