Fusion of Airborne Gravity and Magnetic Images for Improved Detection of Structural Control

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Abstract/Excerpt

Airborne gravity surveys are becoming increasingly more popular in the mining and the oil industry for exploration and geological mapping. Usually in airborne gravity surveys magnetic data are collected as well. Although the magnetic data acquired during gravity surveys generally have lower spectral and spatial resolution than standard high-resolution aeromagnetic (HRAM) data, they add significant value to the interpretation of the acquired gravity data. In many cases, the gravity and magnetic data are responding to the same geological source. For example, structural discontinuities such as faults, fractures and geological contacts can create lateral contrasts in density and magnetization of rocks. These contrasts often generate gravity and magnetic signatures. However, due to density and magnetic variations of the rocks these structural discontinuities are partly detected on the gravity image and partly on the magnetic image. Therefore, we think that if we combine the two images together in a single image and use it to detect lineaments, then we may see trends related to structural control more clearly.

This work tests a new technology called “Image Fusion” to combine gravity and magnetic images acquired through a single airborne survey into a single image. Image fusion combines images from different sources together to produce a fused image that provides an integrated combination of the information contained in each data set. In this work, we tested a discrete wavelet transform (DWT) based fusion technique on the gravity and magnetic images of the Turner Valley airborne gravity survey in the foothills of Alberta, Canada.

The main objective of our work was to test the power of image fusion technique through mapping lineaments in the Turner Valley area using the fused image. Filtered versions of the fused image highlight NE offsets in the Turner Valley structure that are probably related to pressure compartmentalization of the producing reservoir. Further work using steerable filters may highlight additional structural controls.