

Airborne 3D FTG data proves utility for both Minerals and Oil & Gas Exploration/Exploitation

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Abstract

Moving platform 3D Full Tensor Gradiometry (FTG) is now available in both airborne and marine system versions. Current marine systems recently modified to go airborne are proving the adaptability/utility of FTG in transitional and land environments for both petroleum and minerals objectives. Two such surveys in North America, one targeting mineral deposits and the second, a hydrocarbon accumulation at a salt dome illustrate some current applications of this innovative technology.

The minerals deposit data was flown using/comparing both constant altitude and drape survey acquisition methods over an area of rugged topography (7.5x15.5km). Two drilled/sampled ore body targets (250-350m in diameter) were successfully detected with the Tzz tensor and compared/integrated to a dense grid of existing land gravity, Tz. Additionally, the horizontal tensors Txz and Tyz were utilized to determine lineament geometries from grid peak analysis, linking local tectonic elements to prospective subsurface geology and providing insight to ore body formation and hence detection. Frequency-filtering techniques are also employed to further enhance and separate geologic features.

The oil field data was gathered at constant altitude (300m AMSL) and covers an area of a shallow piercement salt diapir (9.7x10.3 km). The primary survey objectives are to image complex salt geology and detect areas of complex overhang geometries where 3D seismic data are inherently ambiguous. In this manner 3D FTG analysis is utilized to reduce risk and geologic uncertainty with respect to ongoing development/directional drilling programs. Further, it is anticipated that the FTG derived salt isopach will be used to reduce valuable iteration time during pre-stack depth migration (PSDM) of the 3D seismic.

These two case studies clearly demonstrate the diverse utility of this exciting new technology.