Mapping Depth to Basement Using 2D Werner Inversion of High-Resolution AeroMagnetic (HRAM) Data

Hassan H. Hassan, Robert A. Charters, and John W. Peirce
GEDCO, Calgary, AB, Canada
hassan@gedco.com

Abstract/Excerpt

Mapping magnetic basement is an important tool for oil and gas exploration in a sedimentary basin because of the basement impact on the geology of the overlying sedimentary rocks and subsequently their control on the formation of oil and gas pools.

Numerous geophysical techniques have been developed to map the basement, but airborne magnetic data inversion is the only tool which can define the basement depth and structure in detail over large areas. It is also the most effective one because of the significant magnetic contrast between the magnetic basement rocks and overlying largely non-magnetic sedimentary rocks. Airborne magnetic surveys are fast and cost-effective relative to other geophysical techniques. However, the interpretation of magnetic data is in general non-unique and often needs to be constrained by other geological and geophysical information such as seismic data and deep boreholes that penetrate the basement. Because of great depth and often low acoustic impedance contrasts, the basement, in some cases, displays a weak reflection on seismic data. Also, often there is sparse well control at the basement level. Hence, the basement is poorly mapped from seismic and well data alone.

The main objective of this study is to map the basement using the 2D Werner inversion technique via an in-house developed approach called MaFIC (**M**agnetized **F**ault **I**dentification **C**ube). We use MaFIC to map faults and magnetic contacts and also to map the depth to the basement. However, this study is only concerned with mapping the depth to the basement. Magprobe™ (Fugro-LCT) is used to compute Werner inversions along profiles. Afterward, we used MaFIC to convert the computed depth solutions to a SEG-Y cube (3D volume). We import the SEG-Y Cube into a seismic interpretation platform in order to pick top of basement horizons. We use deep wells penetrating the basement to constrain our interpretation. However, without well information our interpretation is to some extent subjective.