GEOPHYSICS POSTER 5

A SHALLOW WATER CSEM CASE STUDY: QUALITATIVE AND QUANTITATIVE ANALYSIS

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Controlled Source ElectroMagnetic (CSEM) has been proven to be a valuable tool for remotely detecting and mapping offshore hydrocarbon reservoirs. The method, described by Eidesmo et al. (2002), measures the electrical properties of the subsurface where replacement of saline pore fluids by hydrocarbons influences the resistivity of reservoir rocks.

A CSEM survey was conducted in shallow water area (~90 m depth) where is located at the depocenter of the late tertiary west Luconia delta (Rajang delta), west of the Central Luconia Province, Offshore Sarawak, Malaysia. Generally, geological setting of the area is a regressive, prograding deltaic sequence interrupted by regional transgressive events Earliest Pliocene, Late Early Pliocene and Early to Mid-Pleistocene (Robertson Research, 1989). The basin deepened to the north-western part of the survey area, where thick marine sequences were deposited during Neogene to recent.

Receivers were deployed in two 3D grids to allow for inline and wide azimuth data covering two main prospects which are 12 km apart. In addition, a single receiver line was deployed almost perpendicular to these grids to cover an elongated target not covered by the grids.

The first pass analysis of the resistivity distribution was obtained through a qualitative approach (attribute analysis). This approach is limited to denoting one area more resistive than another, excluding actual resistivity values and accurate depth investigation. In shallow water, the measured data is dominated by an electromagnetic (EM) signal that has propagated along the air/water interface, commonly known as the airwave effect. The airwave effect in the data was reduced by decomposing the EM field into down going and up going component and removing the latter (Amundsen et al., 2006). After the airwave removal, the attributes obtained anomalous features over the prospect area, however this analysis is inconclusive.

A quantitative (inversion) approach was later adopted, which can both account for the airwave and assign resistivity values in depth where sensitivity is provided. Anisotropic 2.5D and 3D inversion was applied and supported that the anomalous features observed in the qualitative approach coincide with high resistivity within the seismic prospect outlines. Even though both inversion schemes (2.5D and 3D) reconstructed the resistive features, it is important to recognize the limitation of 2D data. A 2.5D inversion relies on a 2D approximation of the subsurface, rendering geometry changes orthogonally to the towline unresolved. A grid survey resolves 3D effects and anisotropy by combining inline and azimuth data, i.e. data from receivers both on and off the source towline (Morten et al., 2009).

REFERENCES

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